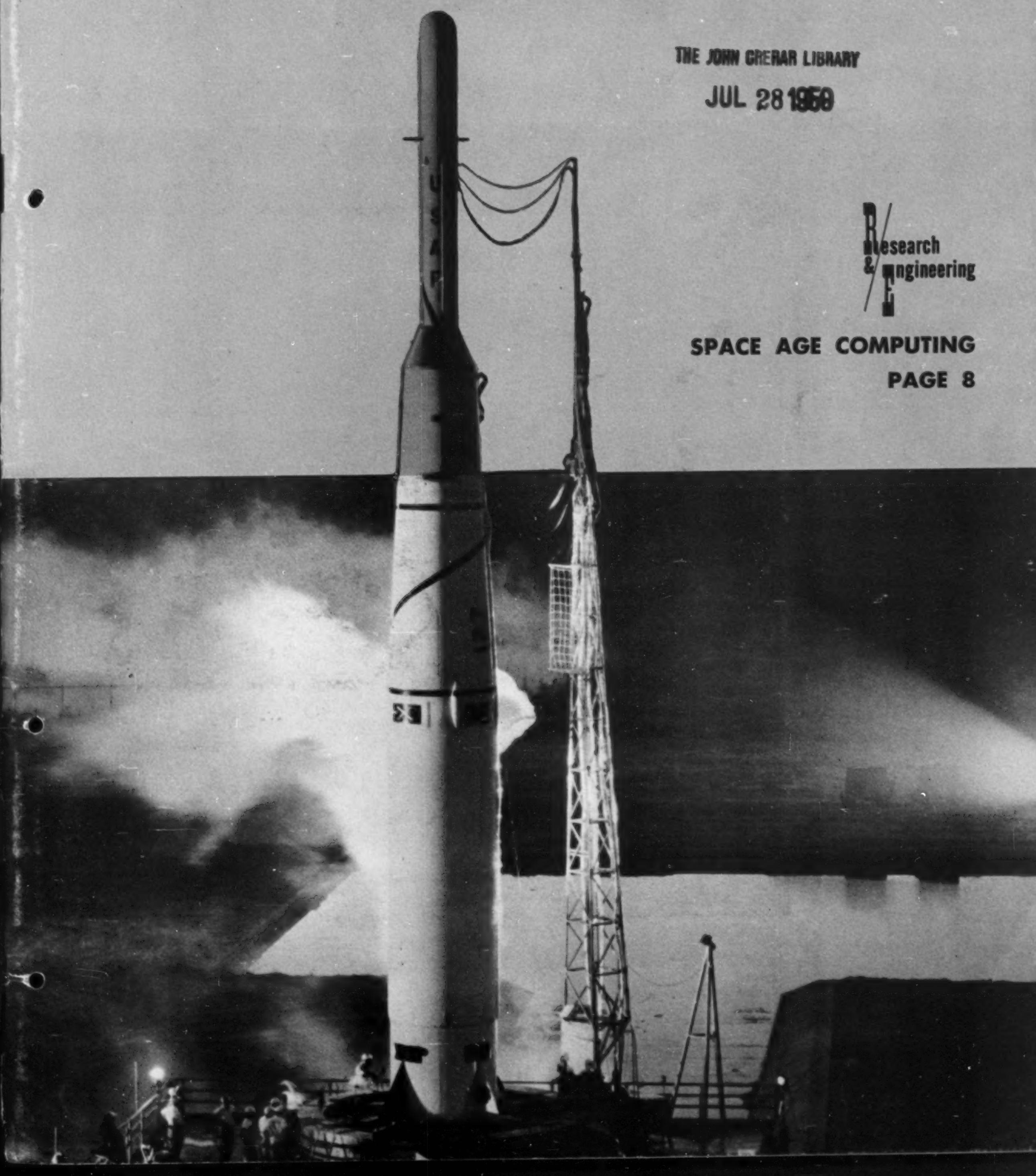
The Magazine of

DATAMATION 59

March/April



Research & Engineering

SPACE AGE COMPUTING

PAGE 8

FIRST CLASS
Permit No. 10194
New York, N.Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY

Reader Information Department

R/E RESEARCH & ENGINEERING

The Magazine of DATAMATION
103 Park Avenue
New York 17, New York

DATAMATION

R/E READER SERVICE CARD Mar./Apr. 1959
NOT GOOD AFTER June 1, 1959

(Please print plainly or type. Show full company name.)

Name____________________

Title____________________

Company____________________

Address____________________

City__________ Zone_____ State__________

☐ I would like to be added to your list to receive RESEARCH & ENGINEERING, The Magazine of DATAMATION

☐ CHANGE MY ADDRESS (Show PRESENT connection ABOVE; list FORMER HERE)

Company____________________

City & State____________________

FOR MORE INFORMATION, ADVERTISEMENTS, EDITORIAL ITEMS

	10	20	30	40	100	110	120	130	140	200	210	220	230	240
1	11	21	31	41	101	111	121	131	141	201	211	221	231	241
2	12	22	32	42	102	112	122	132	142	202	212	222	232	242
3	13	23	33	43	103	113	123	133	143	203	213	223	233	243
4	14	24	34	44	104	114	124	134	144	204	214	224	234	244
5	15	25	35	45	105	115	125	135	145	205	215	225	235	245
6	16	26	36	46	106	116	126	136	146	206	216	226	236	246
7	17	27	37	47	107	117	127	137	147	207	217	227	237	247
8	18	28	38	48	108	118	128	138	148	208	218	228	238	248
9	19	29	39	49	109	119	129	139	149	209	219	229	239	249

For information on employment ads fill in below:

Name____________________

Home address____________________

City__________ Zone_____ State__________

50	55	60	65
51	56	61	66
52	57	62	67
53	58	63	68
54	59	64	69

POGO*

AUTOMATIC PROGRAMMING

for the Bendix G-15

Digital Computer

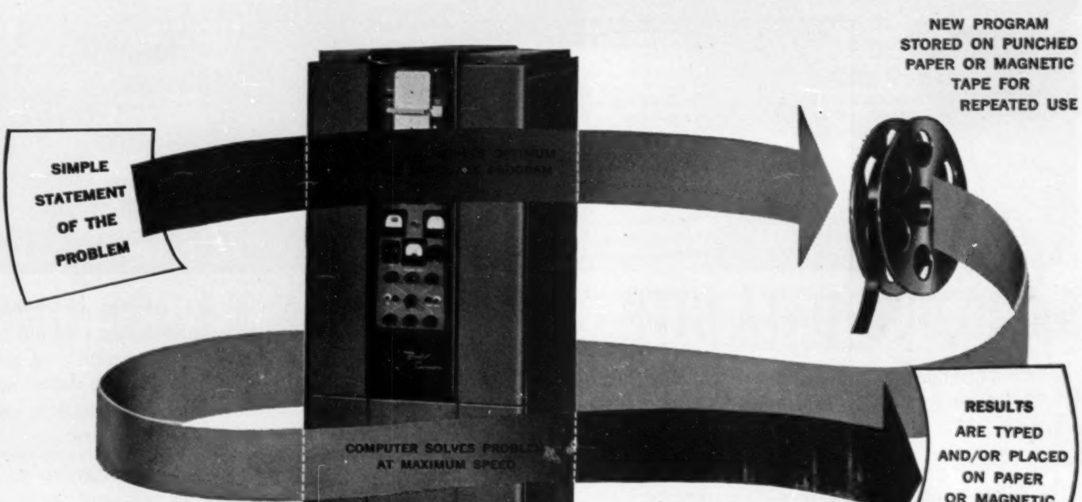
POGO is a new programming system that combines the use of simple, easy to learn commands with all of the G-15's machine language power and speed. A fixed point compiler, POGO recodes a simple statement of a problem in machine language with all commands stored in optimum memory positions. Thus, a programmer with very little training can write high speed production programs.

For the first time in a low-price computer, a set of fully self-contained automatic programming systems is available . . . POGO, with its ability to convert simple commands into fast and powerful machine language programs . . . and the already famous INTERCOM 1000 interpretive system, with its extreme programming simplicity and speed of preparation.

POGO commands are very similar to those used for INTERCOM 1000. The principal difference between the two systems is that POGO, unlike INTERCOM 1000, compiles an optimum machine language program and reproduces it for repeated use. Computing speed is also increased, since no interpretation is required during computation. While floating point INTERCOM 1000 is ideal for open shop problems, POGO may be preferred for production problems that must be solved repeatedly at high speed.

In POGO, data is handled in decimal form. Seventeen accumulator registers are available, as well as twelve index registers, which can be used to modify the effective address of any command. Additional data on the G-15, POGO, and INTERCOM 1000 will be sent on request.

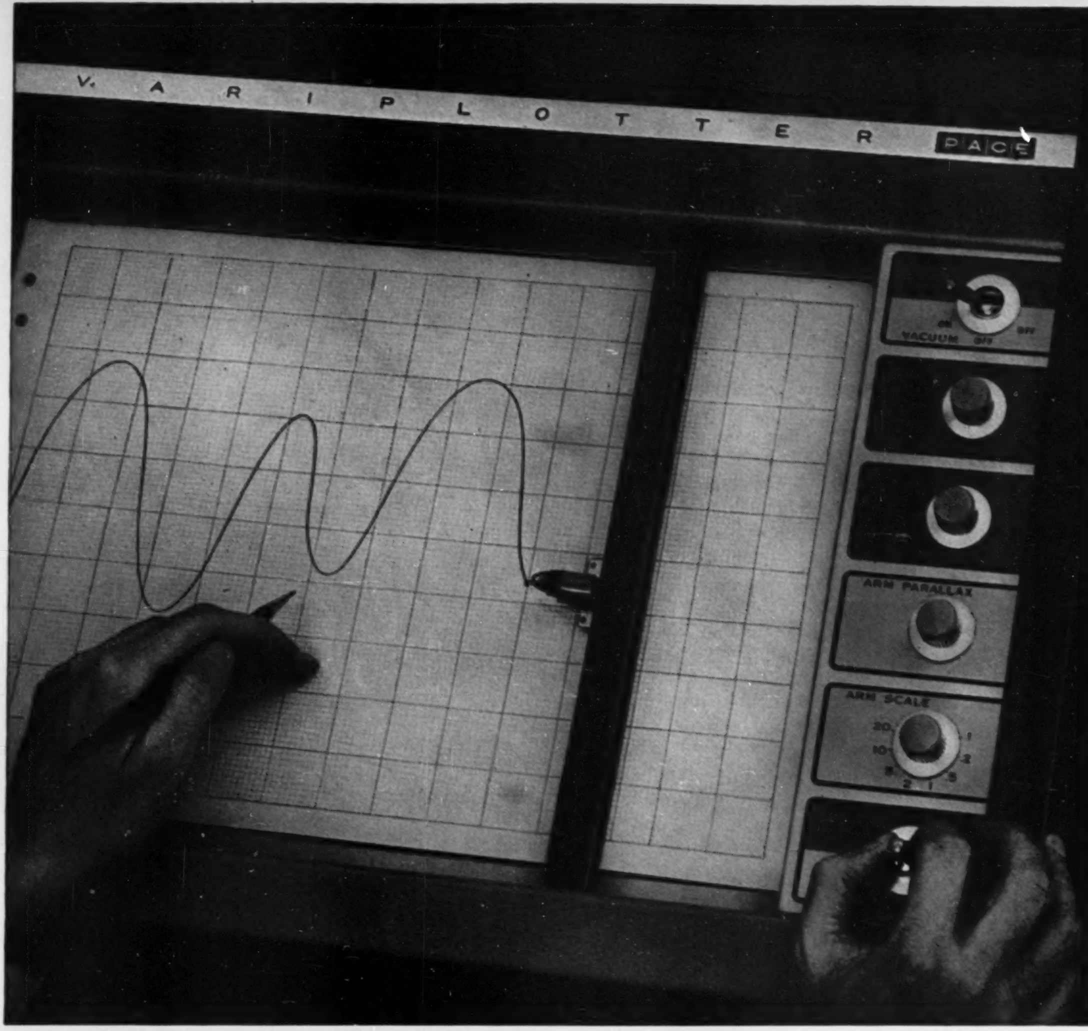
* *Program Optimizer for G-15 Operations*



Bendix Computer

DIVISION OF BENDIX AVIATION CORPORATION. DEPT. E-10 LOS ANGELES 45. CALIF.

Circle 2 on Reader Service Card.



with **EAI** *portable X-Y plotter—*

you can convert data to graphic form quickly...accurately...reliably

With Electronic Associates' new Variplotter Model 1100E, data can be converted immediately to graphic form for quick, easy interpretation and understanding. Graphic display adds life to performance data—makes X and Y relationships instantly, unmistakably clear . . . provides permanent picture-like records of performance.

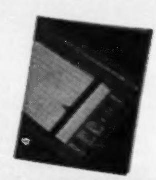
With the addition of accessories, versatile Variplotter will operate as a function generator, or will plot digital information from a keyboard. Its small size (23" L by 17½" W by 9½" H) and light weight (43 lbs.) make it a convenient laboratory tool.

The Variplotter combines high dynamic and static accuracy with a wide range of input sensitivities. Its rugged construction assures dependable, low-maintenance performance.

For name of our nearest representative write Dept. D.

VARIPLOTTER MODEL 1100E FEATURES:

- **Portable table top size**
- **Vacuum hold down**
- **Wide range of input sensitivities**
- **High dynamic and static accuracy**
- **Rugged construction**
- **Ease of maintenance**
- **Differential inputs**



For complete specifications write for Booklet AP-810D

ELECTRONIC ASSOCIATES *Incorporated*

ELECTRONIC ASSOCIATES INC.

LONG BRANCH, NEW JERSEY

Circle 6 on Reader Service Card.

LGP-30

ROYAL PRECISION

Here is the low-cost, desk-side electronic digital computer you need for general design and system optimization

Speeds optimum design of new products and equipment!

Operating from any convenient wall outlet, the compact, powerful LGP-30 will today furnish you with high-speed electronic computation wherever you need it . . . will eliminate tedious hand calculations . . . help you free up more creative time.

Combining large memory (4096 words) and stored-program operation, the LGP-30 gives you twice the capacity of any computer in its class, yet is by far the easiest to program in basic machine language. Simplified controls can be operated with only minimum computer experience. Answers are printed out directly —require no deciphering. Best of all, even with these many unique advantages, the LGP-30 is the lowest-priced complete computer you can buy. What's more, auxiliary high-speed input—output equipment is available for system expansion.

No expensive installation or air-conditioning required. Customer training is free. An extensive library of programs and sub-routines is available—as well as membership in an active users organization. Sales and service facilities are maintained coast-to-coast.

For further information and specifications, write Royal McBee Corporation, Data Processing Division, Port Chester, N. Y. In Canada: The McBee Company, Ltd., 179 Bartley Drive, Toronto 16.

ROYAL McBEE · *data processing division*

Circle 7 on Reader Service Card.

DATAMATION 59

the automatic handling of information

volume 5, number **2**

FEATURES

DEPARTMENTS

ON OUR COVER—Able I, representing the nation's first moon shot attempt, is shown here on its launching pad at Cape Canaveral, Fla. It was designed and developed by Space Technology Laboratories, the Los Angeles firm responsible for the scientific direction of the Air Force's ballistic missile program. STL also handled the computation, tracking and data reduction for the project. (See page 8.)

FRANK D. THOMPSON *Publisher*

GARDNER F. LANDON *Vice President*

SANTO A. LANZAROTTA *Editor*

ETIENNE J. GUERIN *European Editor*

BETTE L. HOWE *Production Manager*

MARTHA KNOWLES *Circulation Mgr.*

RICHARD W. NIELSON *Sales Mgr.*

WARREN A. TIBBETTS
New England District Manager
434 Webster St., Manchester 4, N. H.
NAtional 5-9498

RICHARD W. NIELSON
Eastern District Manager
103 Park Ave., N. Y. 17, N. Y.
LExington 2-0541

ALBERT PUDVAN
Cleveland District Manager
3537 Lee Road, Shaker Heights 20, Ohio
WAshington 1-9370

GILBERT THAYER
Midwest District Manager
201 N. Wells St., Chicago 6, Ill.
Financial 6-1026

HAMILTON S. STYRON
Western District Manager
10373 W. Pico Blvd., Los Angeles 64, Cal.
BRadshaw 2-2643

EDITORIAL OFFICES — 10373 WEST PICO BLVD., LOS ANGELES 64, CALIFORNIA

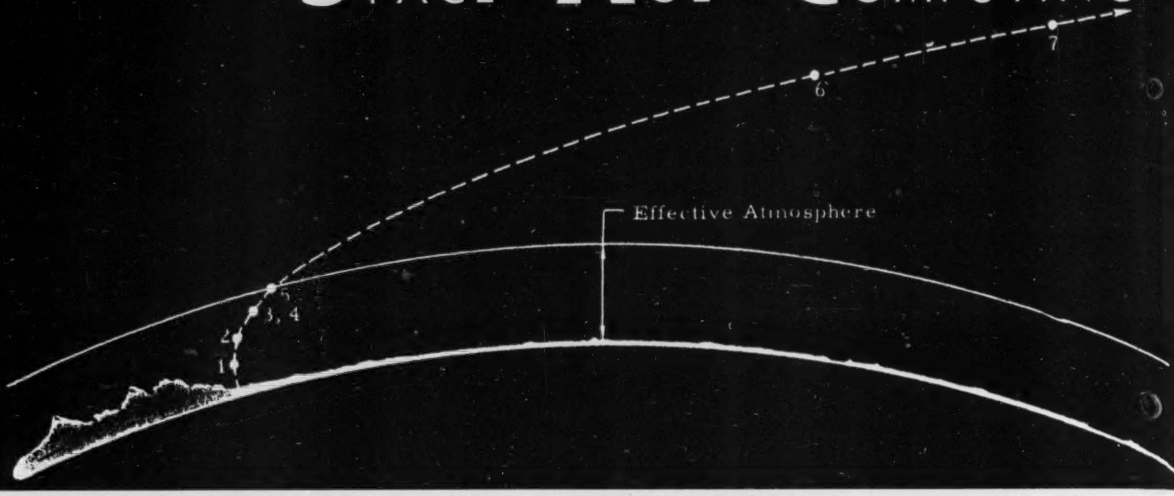
OVER 24,000 CIRCULATION

Research and Engineering is circulated without charge by name and title to the manufacturers and users of automatic, information-handling equipment in all branches of business, industry, government and military installations. Qualified individuals in the United States and Canada are invited to request this publication on their company letterhead, stating position and the firm's business. Available to others by subscription at the rate of $5.00 annually; single issue, $1.00 when available. No subscription agency is authorized by us to solicit or take orders for subscriptions in the United States, Canada or overseas.

Published bi-monthly by the Relyea Publishing Corp., Frank D. Thompson, president. Executive, Circulation and Advertising office, 103 Park Ave., New York 17, N.Y., LExington 2-0541; Editorial office 10373 W. Pico Blvd., Los Angeles 64, Calif. BRadshaw 2-5954. Published and accepted as a controlled circulation publication at Indianapolis, Indiana.

R/E, The Magazine of DATAMATION, welcomes manuscripts of three general types: application articles dealing with small, medium and large electronic data processing systems; articles covering the design of components, sub-systems and systems; and other general articles of interest to the data processing industry. Material submitted should be accompanied by pictures and illustrations when possible. Unsolicited manuscripts to be returned to writer should include return postage but editor assumes no responsibility for their safety or return (although all reasonable care will be taken).

SPACE AGE COMPUTING



In late 1957, by cross breeding missile systems, Space Technology Laboratories, Inc., had developed an Advanced Re-entry Test Vehicle for the Air Force Ballistic Missile Division to carry an ICBM nose cone at the full range of 5,500 nautical miles. As it was later proved, this combination of a Thor ballistic missile mounting the second stage developed for the Vanguard program, and an additional third and fourth stage, offered an opportunity for the United States to place a reasonable payload in lunar orbit. Further plans to build such a missile were considered. Prior to March 27, 1958, Project Able-1 appeared to be an unidentified synonym for a high priority request in STL's machine room. But from that date, when the Advanced Research Projects Agency (ARPA) authorized a program of three lunar shots, Able-1 became a real challenge to the Computation and Data Reduction Center of STL.

Put in perspective, complete success was to mean much more than computing—it meant the successful wedding of two independent propulsion systems; the development of a payload and all the included scientific instrumentation; plus the development of payload telemetry and a command/doppler system that had to operate at greater distance than had ever been required before. A ground tracking network had to be built and tested.

Still, a special responsibility rested on computing personnel. The other systems all were engineering challenges extending the state of the art. They could fail, as indeed they sometimes would, and sympathy would mellow the explanation. But if all went well as the vehicle left the launch pad and headed for its lunar rendezvous, what could a computer programmer say in explanation if he could not answer the simple question "where is it?"

This is an account of the role that computing and data processing played in Project Able-1 (Pioneer). It may indicate the demands that unnamed missions of the future will place on tomorrow's computers.

by ROBERT W. RECTOR
Staff Mathematician
CDRC, Space Technology Laboratories

Computing and data processing requirements associated with the space probe programs at Space Technology Laboratories fall into three main areas:

I **Trajectory and Engineering Computations** – This includes the planning of trajectory and tracking methods and execution of such programs to obtain the nominal trajectories. It continues through the gamut of scientific problems in propulsion, structures, aerodynamics and controls to the routine task of "making book" – listing the weights and computing the center of gravity for the missile system and all its major components. These are all computing tasks that must be accomplished to put the missile on the stand.

II **In-Flight Tracking and Data Acquisition** – This concerns the surveillance system and the appropriate computer operations necessary to obtain and process precise tracking information if the Operations Center established in Los Angeles is to control and coordinate all data handling and decision processes that occur during the flight.

III **Data Reduction and Analysis:** Flight telemetry data obtained from the ground stations of the tracking network must be put in suitable form for interpretation of scientific experiments and the reconstruction of trajectories for performance evaluation.

dp planning

Planning for the data processing responsibility for the lunar probe began as early as 1956 with research on integrating techniques that might be used specifically for rapid and accurate integration to obtain space vehicle trajectories. This work resulted in several internal papers dealing with the general problem of the integration of or-

The author acknowledges his debt in the preparation of this article to Space Technology Laboratories, Inc., for the 1958 NASA/USAF Space Probe (ABLE-1) Final Report which was prepared for the Air Force Ballistic Missile Division, HQ, ARDC under contract AF 04(647)-205, 18 February 1959. Permission to excerpt portions of the technical details from the report and to incorporate them into the body of the text was granted by STL.

dinary differential equations. By late 1957 there was an attempt to formulate the general problem of lunar trajectories, but the pressure for the free flight trajectories mounted and by January, 1958, the first machine program was checked out and in production. This program considered the earth, moon and sun as the only effective celestial bodies. In addition the initial conditions were chosen as a point and velocity in space rather than the more complete conditions of launching from the earth's surface. In integrating the equations of motion, the routine allowed the option of selecting either a Runge-Kutta 4th order method, or a multi-step prediction-corrector formula of the Milne type, which used the Runge-Kutta method as a starting procedure. Even with the option which proved its value by permitting the checking of faster Milne formula against the stability of the Runge-Kutta method, the program was a major exercise in coordinate transformations. Earth-centered, moon-centered, site-centered and inertial reference systems were required and points had to be expressed in rectangular and spherical or radar coordinates. Such transformations are necessary if the program output was to be presented in usable form.

At this same time a great deal of work was being done in the numerical analysis aspects of the solution of the n-body problem arising in the determination of satellite and space trajectories. In the initial analytic approximation, the earth-moon-vehicle system had been treated as a succession of two-body problems. Among the many questions being investigated were the accuracy of numerical integration procedures, machine time required for long trajectories, the effect of uncertainties of input data, and whether analytical formulas for the orbits of some of the planets should be assumed or whether it was better to compute their orbits directly from the equations of motion. Investigation of the effects of small changes in certain parameters on space trajectories was effected by a computer program prepared to solve the set of perturbation equations obtained from the original equations of motion by differentiation with respect to the parameters in question.

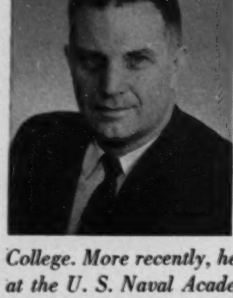
new trajectory required

As plans for the lunar probe progressed a new trajectory calling for the incorporation of the powered flight portion, taking the space vehicle from the launching position to the hypothetical point in space that had been considered as a starting point up to now, was required. Accordingly, the Thor targeting program was modified to simulate the powered flight trajectory for a multistage missile, and an improved three-body unpowered trajectory program was prepared. A special procedure for integrating a system of second-order differential equations with the first derivatives absent, was used to compute the motion of the moon as well as the motion of the vehicle. In this routine, the step size was automatically doubled or halved in order to reduce the number of time steps required in the integration procedure, while at the same time maintaining the required accuracy. The modified Thor program and the improved three-body program were then joined to form an operating package. By June, the computer was being used to determine various trajectory parameters and establish accurate actual firing schedules and trajectories. The computing service requirements in this area accelerated as the dates for the initial firings drew near.

To appreciate the constraints that were placed upon the determination of satisfactory trajectories, one has to realize that when the burnout point of the powered flight lies out of the moon's plane, as indeed it did, a different set of burnout conditions must be chosen each day to hit the moon. Also the sensitivity of the guidance system to error changes each day. Thus, for a three-dimensional flight, one problem is to determine the optimum day of month for firing; the second is to find the correct combination of burnout, azimuth, velocity and flight path angle. Further constraints on the inertial attitudes of the separate stages are demanded. The vehicle must be in the proper geographic orientation for the command firing of retro-rockets, and the relative velocity of the vehicle with respect to the moon had to be low enough so that the velocity increment empowered by the retro-rockets would result in capture.

Numerous trajectories were computed with varied missile configuration and hold times. The flight path angle, azimuth, burnout velocity, as well as other parameters, were varied to produce a trajectory which was consistent with the constraints. These studies led to the actual establishment of the first Able-1 firing schedule.

Meanwhile ground stations were established by STL at the Air Force Missile Test Center at Cape Canaveral, Florida, on Hawaii and at Singapore, to receive telemetry data and to track the space vehicle. The Jodrell Bank Radio Telescope Installation of the University of Manchester in England was to cooperate in tracking operations. The



Robert W. Rector, staff mathematician of the Computation and Data Reduction Center, Space Technology Laboratories, Inc., has had 19 years experience in mathematics, education and research in numerical analysis. He has held several academic positions at Stanford University and Compton Junior College. More recently, he was an associate professor at the U. S. Naval Academy, Annapolis. Dr. Rector (Ph. D., Mathematics, Univ. of Maryland) joined STL in 1956. He served as liaison between Project Able operations and the Computation and Data Reduction Center.

MIT Radar Station at Millstone Hill, Massachusetts, also cooperated in providing a tracking facility. This primary ground system received assistance from other cooperating agencies. The Naval Research Laboratory Control Center in Washington, D. C., relayed tracking data from their Minitrack stations to the Operations Center in Los Angeles via the STL Communications Center at Cape Canaveral. Telephone contact with the NRL Control Center facilitated the interpretation of the Minitrack tracking data.

These ground stations were equipped with phase lock receivers that were able to lock onto signals of -155 dbm or better The phase detector demodulated the telemetry information so that the telemetry subcarriers were available for recording onto magnetic tape or for data reduction by discriminators directly from the phase detector output. The Hawaii and AFMTC stations were equipped with command/doppler subsystems to fire the vernier velocity adjustment rockets on the third stage and the retro-rockets on the fourth stage.

In tracking the missile each of the stations had unique capabilities. This fact made the tracking program much more complex for it was necessary to allow for distinctly different forms of input and output. When estimates of accuracy were associated with input entries, severe weighting problems were imposed.

The Millstone station was to skin-track the second stage of the missile using 400 mc long-range radar until well after separation of the third stage. One half hour after launch Millstone was to switch to passive tracking and thereafter would give azimuth and elevation data.

The command/doppler system at Cape Canaveral was to supply radial range rate for the first sixteen minutes after launch.

The Manchester radio telescope was to measure azimuth and elevation by transmitter tracking.

The Hawaiian station was to perform the same function but using a 60-foot parabolic reflector in place of the 250-foot reflector at Manchester. In addition there was a two-axis interferometer at Hawaii designed to give angular directions with a high degree of accuracy.

The antenna system at the Singapore station had too broad a beam width to provide any significant tracking information.

communications system

The communication network of the Able-1 program which connected these ground stations was designed to fulfill two basic tasks:

(1) To provide orientation information rapidly to each of the ground tracking installations to enable them to locate and detect the beacon output of the fourth stage of the Able-1 vehicle, and

(2) To process data rapidly as required for firing the fourth stage retro-rockets.

The selection of the site for the Operation Center that was to serve as a control point pointed up the role that data processing was to play in the operations. The decision was to locate the Operations Center adjacent to the IBM 704 computer facility in order that the flow of information between the trajectory computing facility and the ground stations be as smooth as possible. This operations Center was also used as headquarters for the Project Director.

The basic communications system between the ground stations and the Operations Center in Los Angeles was a teletype network. The stations of this network and general relationship between the elements is shown on Figure A. During operations, a 24-hour leased wire teletype service at 60 wpm was provided for Hawaii, Manchester, Singapore, and AFMTC. TWX facilities were used to communicate with Millstone as needed each day.

Backup telephone facilities were used during critical periods. Two conference nets were used: one linked Hawaii, Manchester, and the Operations Center, the second conference net linked Millstone, AFMTC, and the Operations Center. These telephone facilities were used during launch and for several hours thereafter until the operation became routine.

During periods between operations, teletype service was maintained for 8 hours per day to Hawaii, for 12 hours per day to Manchester and Singapore, and 24 hours per day to AFMTC. TWX service to Millstone was always available.

These communications links were used for administrative traffic such as logistics, technical discussions, etc., between operations. During operations these communications networks were used to inform the ground stations of exact time of launch, of steering information, and for transmission of instructions. The stations also sent tracking and telemetry information to the Operations Center.

While the ground stations and the communication network were being built, the Computer Programming Department turned to its part of the task of making the system operable. The nominal trajectories were established and computer runs were made to furnish the tracking stations with the appropriate position data in the suitable coordinates that would be required to track the vehicle from each of the individual sites if the flight remained close to the normal trajectory. Attention was also directed toward the problem of real time calculations required for vehicle tracking. The basic computer operation was to involve a least-squares fit to blocks of observed data. Using a linear expansion of vehicle coordinates around the nominal trajectory, the variations from the nominal trajectory would be employed to give improved estimates of burnout conditions. This set of conditions then gave rise to a new nominal and the planned operation called for calculating the new nominal trajectory when early tracking data indicated that the trajectory deviated too far from the nominal for a linear expansion to be adequate.

The planned operation for the determination of the appropriate retro-rocket firing time called for a trajectory to be run to the vicinity of the moon every time that a significant improvement in trajectory determination from tracking data was accomplished. Conditions near the moon were examined and a first approximation to the desired time of retro-rocket firing was determined from two-body calculations of the vehicle energy with respect to the moon after retro-rocket firing. Several trajectories were planned to be run with retro-rocket firing times near this approximate time. The resulting lunar satellite trajectories were to be examined and the actual firing time decided on the basis of the nature of the lunar orbits. As approximate and, later, exact times for retro-rocket firing were calculated, these were to be transmitted by teletype to the main station at Hawaii, from which commands were to be transmitted to initiate retro-rocket firing. Although the retro-rocket could have been fired from Hawaii based on times transmitted earlier in the event the Operations Center lost communication with Hawaii, the planned operation called for direct teletype and telephone contact with Hawaii at the time of retro-rocket firing to insure that the retro-rocket command was transmitted as near the optimum time as possible.

computer essential

Anticipating the large volume of missile tracking data that would be received in view of the heavy responsibility imposed upon the Operations Center in furnishing revised tracking data to the radar stations, it was obvious that extensive use of a high speed computer was essential.

The computer programs necessary to mechanize the work of the Operations Center were conceived, programmed for the 704 Computer and checked out in accordance with a stringent time schedule. In all, four master computer routines were made available. In addition, final modifications were made in the existing trajectory program. The first of the four new programs furnished a time conversion table from Greenwich Mean Time to minutes after missile lift off. There were two tape processing routines, one processing the information from the trajectory output tape to prepare a tape file of partial derivatives, elevation angle, azimuth angle, range, range-rate, and two direction cosines, with respect to missile burnout conditions of velocity, attitude, azimuth and altitude. This master tape with its complete file of information was the key to the successful functionings of the Operations Center. The master tape furnished nominal trajectory input to a third computer program. This program, when supplied with actual tracking information received from any of the radar stations, determined the improved approximation to actual missile burnout conditions. The initial version of this last program contained four possible calculating procedures, any one of which could be requested by the Operations Center Director. A final program took the output from the trajectory program and prepared a time, elevation, and azimuth angle printout for any specified radar station. All of these programs were tested extensively, using dry runs prior to the initial firings.

countdown

In the actual August 1958 firing, the countdown and first calculations were carried out in a most satisfactory manner. The planned computer checkout was performed. At the time of lift off, the Operations Center was in contact with Manchester, Millstone and AFMTC (Cape Canaveral). The Operations Center and all participating ground stations were in a state of readiness.

The Operations Center received the exact lift off time, 12:18 GMT, 17 August from AFMTC by teletype. Almost simultaneously a teletype statement from Millstone said that they had not acquired the powered flight. A telephone

Edward M. Hackman, supervisor of 704 operations; Bobby C. Sageley, senior operator and William A. Sassaman, computer director (left to right) read trajectory corrections from on-line printer in STL's computing center.

Over-all view of the STL computing center.

report from AFMTC said that the first stage had exploded. Officially, the flight terminated at 73.6 seconds due to a malfunction of the first stage propulsion system.

The second shot of the series was now scheduled for October. This gave the Laboratories and the Computing Center a chance to revise minor phases of the program. Changes were effected to permit easier recognition of input data received from a large number of ground stations and to incorporate a more accurate method of determining burnout conditions from early quick-look data.

While the August shot did not test operating procedures in the computing area, the October firing found the computing phase functioning satisfactorily. A staff of 31 from the Computation and Data Reduction Center handled their specific assignments with a minimum of confusion. The computing facilities were operated on a 24-hour-a-day basis and were prepared for continuous operation while the missile was in flight. A 704 computer back-up facility had been arranged with the El Segundo Division of the Douglas Aircraft Company.

second firing

Everything went smoothly during the countdown on October 10. A preliminary report showed that all the ground stations were ready. The Operations Center received by teletype the lift-off time 0342/13 EST, 11 October 1958. The vernier firing task reported to the Operations Center that eight vernier rockets had been fired and estimates of the burnout conditions were stated. The data furnished the Operations Center by the vernier firing task indicated that the vehicle velocity was low by at least 200 to 300 ft/sec. Momentary confusion resulted when Manchester reported the vehicle had been acquired at approximately the nominal position. Manchester was informed that the best estimate available at the Operations Center was that the vehicle velocity and position were appreciably below the nominal. The Manchester station discovered that the vehicle was being tracked on a minor lobe of the antenna which by coincidence was approximately as far from the main lobe as the vehicle elevation was in error (approximately 13°). This mistake was rectified and Manchester tracked satisfactorily from approximately T plus 60 minus on. Preliminary estimates of burnout velocity magnitude indicated that the burnout velocity was at least 400 ft/sec low and the maximum altitude would be less than 100,000 nautical miles.

As soon as it was realized that the vehicle velocity was so low that the general vicinity of the moon would not be reached, the nature of the resulting elliptical orbit was examined analytically, graphically, and on the 704 computer. Estimates were made of the probability that the firing of the retro-rocket would result in a permanent earth satellite. The probability appeared to be sufficiently high that a significant portion of the remaining ground station activity was devoted to attempts to fire the retro-rocket. Continued attempts were made from AFMTC and from Hawaii to fire the fourth stage rocket, but without success.

As further tracking data was received from the Manchester, Millstone, and Hawaii ground stations, increasingly accurate estimates of the vehicle trajectory were calculated. Revised steering data was sent to ground stations by teletype as soon as calculated.

Questions as to the accuracy of the trajectory determination arose when apparent range rate measurements from Hawaii indicated that the vehicle velocity was approximately 3000 ft/sec higher than indicated by the best trajectory estimate available at the Operations Center. Later, the Hawaii measurements were realized to be spurious because of a lack of firm lock in the doppler circuitry.

The best estimates available of the trajectory based upon all available data are as follows:

Launch time	0342/13 EST 11 October 1958
Burnout conditions time	0347/20 EST
altitude	1,410,000 feet
velocity magnitude	34,524.5 ft/sec
velocity angle from vertical	64.74°
Maximum altitude (from surface)	70,717 statute miles (61,452 nautical miles)
Re-entry time after lift-off	43 hours 17.5 min.

Figure B compares the actual tracking data with the theoretical tracking data calculated on the basis of the final trajectory parameters summarized above. Figure C shows the projection of the vehicle path in the plane of the moon's orbit.

During the entire exercise approximately 100 computer runs were made on STL's 704 computer using 21 hours of computer time. Due to the significant deviation of the actual trajectory from the nominal the number of computer runs made during the first 12 hours of the flight exceeded the anticipated number of runs by a factor of two. Even with these heavy demands computer results were returned to the Operations Center within the allotted time schedules. The Douglas computer was utilized for approximately 60 minutes in intermittent confirming runs.

While there was keen disappointment that the vehicle had failed to reach and orbit the moon, the project could successfully complete the primary objective of the program which was to obtain scientific data in cislunar space. To accomplish this goal, the data collected by the ground stations from the telemetry system of the payload had to be reduced and analyzed. But this was only one half of data reduction and analysis phase. The other responsibility was to assist in providing data in the proper form so that the engineers could analyze missile performance and malfunction.

To the maximum extent possible, within the weight and power restrictions, the experiments carried in the payload were designed to obtain scientific measurements of the environment in cislunar space. A magnetometer experiment

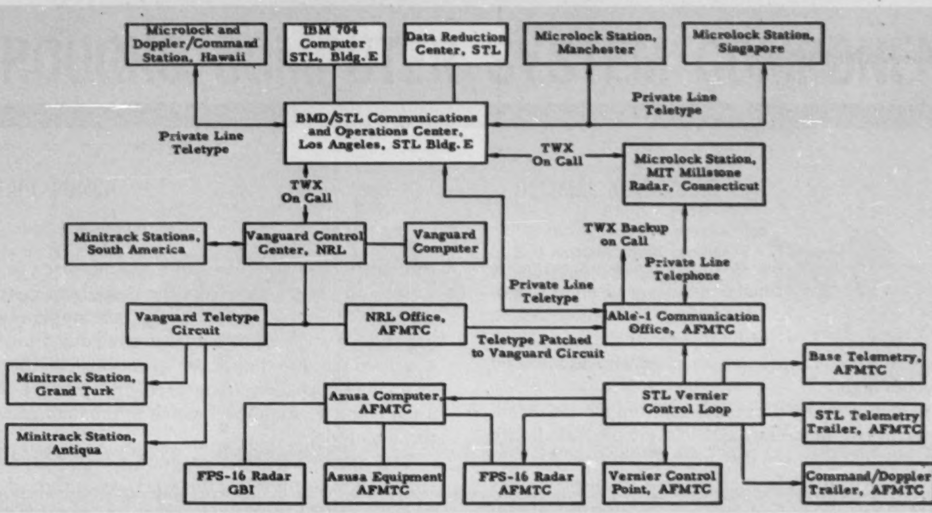


Figure A. Ground station network.

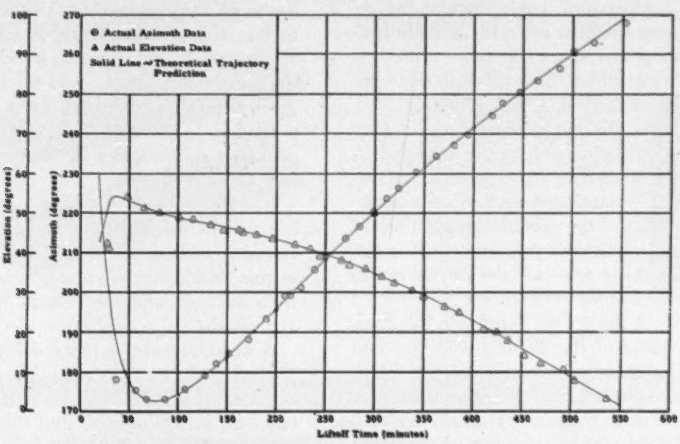


Figure B. Actual tracking data of Manchester compared with theoretical tracking.

Since 1954, Space Technology Laboratories has been responsible for overall systems engineering, technical direction, and related research for the Air Force Intercontinental and Intermediate Range Ballistic Missile Programs (Atlas, Titan, Thor, and Minuteman, and the recent highly successful Thor-Able series of ICBM-range re-entry test launches).

At STL, the Computation and Data Reduction Center is the centralized mathematical and computing facility which executes the computational aspects of the work of the separate laboratories. Its Mathematical Analysis Department, assisting in the formulation of mathematical models and responsible for advanced numerical analysis, contributed heavily to the early phases of the trajectory computations. Its Computer Programming Department was responsible for the execution of the actual programs used for in-flight tracking, as well as the myriad of other engineering programs written for the IBM 704 and Remington Rand UNIVAC Scientific 1103A. Its Data Analysis Department provided equipment and personnel to assist with the data reduction, including personnel experienced in data reduction programs utilizing the high-speed computers and other specialized equipment.

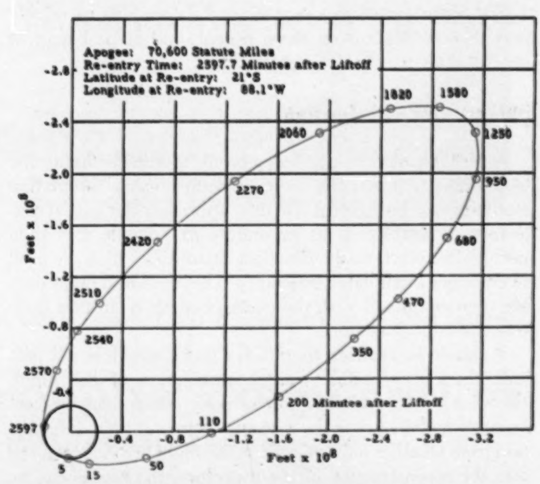


Figure C. PIONEER I, projection of the vehicle in the plane of the moon's orbit.

was devised to measure the earth's and moon's magnetic fields. The flux and approximate energy spectrum of micrometeorites were measured. A facsimile television system was included. Internal payload temperature was measured. To measure radiation in space, an ion chamber was installed in the October flight.

In the reduction of the data obtained from the ion chamber experiment two different methods were evaluated with respect to reliability. In the first method the in-flight calibration was used as the reference; and the frequency difference between the in-flight calibration and the signal was looked upon as determining the radiation level. In the second method only the temperature dependence of the response was taken into consideration using the in-flight calibration as a temperature sensor. Once the temperature was known the calibration curve which corresponds to that temperature was used to determine the radiation intensity.

The data obtained from the magnetometer are exceedingly complex and are still being statistically analyzed. A computer program was utilized to determine deviations from a theoretical model. By anticipating the needs of the experiment the computation of the predicted magnitude of a theoretical geomagnetical field component lying in the plane perpendicular to vehicle spin axis was carried out as part of the calculation of nominal trajectories.

The program contains a routine to determine the three components of the gradient of the geomagnetic potential corresponding to the instantaneous vehicle position. With the direction of spin axis known the component perpendicular to the vehicle spin axis is computed. Thus the nominal trajectory prints out the value of this component predicted from the spherical harmonic expansion for each interval of time. A digital computer technique such as this is invaluable in the analysis of experiments.

The requirements for post-flight data analysis of missile performance were even more urgent and steps began at once to reconstruct the trajectory.

performance evaluation

In evaluating the performance of a missile flight, the technique of trajectory reconstruction using simulation methods can be helpful. In this approach the actual trajectory is established as accurately as possible and then perturbations are made in various quantities which are used to compute a simulated trajectory. The measured flight data are then compared with the corresponding quantities from the simulated trajectory.

It should be realized that such a technique does not provide the only possible true reconstruction of the flight. However, if the position and velocity components are accurately matched over the entire trajectory and the information from all other data sources on the flight are incorporated into the reconstruction of the trajectory, the results can be accepted as an accurate description of the actual trajectory.

A succession of simulation runs were made using various combinations of autopilot drifts and increased or decreased thrust and weight flow from the propulsion system. In addition, all information concerning burning times and pitching rates and times which was available from telemetry was used. By inserting these quantities into the computer as small perturbations in the preflight nominal performance, a more and more faithful match to the data gathered from the actual flights was achieved.

The digital computer program which was used to calculate all trajectories for this work was a three-dimensional trajectory study program. It obtains true inertial coordinates and employs an oblate earth gravitational potential. This is the same program used to calculate the nominal trajectories for the Able vehicles. By the insertion of program constants, all autopilot and propulsion variations which continue throughout any stage could be incorporated into the program as well as any peculiarities of sequence (e.g., lengthened first stage vernier period). The best estimates from telemetered quantities of thrust and flow rate programs were used.

These studies carried out for Pioneer I, as the lunar vehicle was called, show that excellent performance was obtained from both the first and second stages. At first-stage engine shutdown the velocity was about 800 ft/sec greater than nominal, and the velocity vector was about 2.5 degrees high.

A smooth transition to second stage operation was accomplished, and a second stage burning time of 104 seconds was obtained. Engine shutdown was commanded by the integrating accelerometer, and the velocity at this time was between 23,125 and 23,150 ft/sec or about 190 ft/sec less than the desired velocity. This difference was primarily due to the fact that the integrating accelerometer computed along a lofted trajectory. At shutdown, the velocity vector was lofted by 3 degrees.

At third stage burnout, the inertial velocity was approximately 500 ft/sec less than the desired value of 35,206 ft/sec. Subsequently, all vernier rockets were fired in an attempt to make up the velocity deficit, but their impulse was not sufficient, and the required velocity was not achieved. The fourth stage reached an altitude of 70,700 statute miles, and good payload telemetry data were obtained during the flight. The attempt made to convert the payload into a high altitude satellite by firing the fourth stage probably failed because of low internal temperatures which left the missile batteries incapable of supplying the necessary ignition current.

The project concluded with the firing of a third missile on November 8, 1959. The failure of the third stage to ignite limited the maximum altitude to 970 miles. While useful scientific information was obtained, the demands upon the data handling system were minimal. The full scale testing of space age data processing lies ahead. With the Atlas Satellite of Project SCORE, the Polar Discoverer I and Pioneer IV already over the horizon the day for processing data from space has dawned. ●

Circle 140 on Reader Service Card.

DATAMATION *in business and science*

SYLVANIA ABSORBED BY GEN TEL

Merger of Sylvania Electric Products, Inc., into General Telephone Corp., to form General Telephone and Electronics Corp., became effective March 5. Under the merger Sylvania is a wholly owned subsidiary of General Telephone and continues operation as a separate entity . . . Awarding of four Signal Corps contracts in excess of $5 million to Sylvania for the development and production of three MOBIDIC computers and for programming assistance has been announced by the Department of the Army and Sylvania. The awards bring to a total of four the number of MOBIDICs ordered by the Army and total Army funding on the program now stands at $6.5 million . . . First "fixed plant" installations of two MOBIDICs will be made by Sylvania at its Data Processing Center, Camillus, New York, and its Data Systems Operations, Needham, Mass.

AF'S 433L BIDS DUE BY APRIL 24

Proposals went to industry (including major computer manufacturers and intallations) on March 13 in connection with Air Force contract 433L. This contract, originating at the AF Cambridge Research Center, Hanscom Field, Bedford, Mass., involves the gathering and processing of meteorological data. Bids are due in no later than April 24 and shortly thereafter a contract will be let.

RECOMP II DEMONSTRATED AT MEETING

Autonetics opened an Industrial Products sales office in Los Angeles March 10 and 10 days later demonstrated its Recomp II at an L.A. DCA meeting (a first!). The system is priced at $86,000 and will lease for $3000 per month. It features built-in floating point. A spokesman said 11 Recomp II's "have been committed." No commercial deliveries have been announced as yet.

A LOOK AT GE'S COMPUTER DEPARTMENT

General Electric officially opened its Computer Department, located north of Phoenix, February 25. At a press conference that day, executives indicated that for the present and immediate future the department will concentrate on further development of special purpose and process control machines and that no activity is anticipated in the gp field other than manufacture of the 304 which GE has undertaken for NCR. The Computer Department will market the 304 within the company. (Two GE departments have placed orders.) NCR will handle commercial marketing. A programming package called NEAT (National Electronic Automatic Technique) will be ready when the first delivery is made in August, an NCR spokesman promised. DATAMATION was unable to determine the number of routines which would be available in the package. There will also be a programming package for 304 tape commands. The first ERMA (G-100) will be installed for the Bank of America in May. The prototype installation in San Jose's BA has been effectively debugged, GE states, thus permitting first delivery of a fully operational system. (ERMA accounts for the bulk of the Computer Department's $50 million-plus backlog.) A company spokesman seemed very optimistic about GE's process control line -- especially the 312. Manager of marketing, George Hagerty, claims the 312 is not only an excellent industrial machine but that it can be adapted to business or commercial uses as it stands. (It has a 4,000 word drum memory.) One came away from Deer Valley Park with two main impressions: the Computer Department has complete confidence in the equipment it is turning out and the GE-NCR combination might soon have some surprises in store for the industry.

EDP FIRST FOR L.A. SCHOOL SYSTEM

Los Angeles City School System has leased a Burroughs Datatron 205 and has thus become the first school system in this country to adopt electronic data processing methods. The city's Board of Education received bids last December from Remington Rand, IBM and Burroughs. Selection was made March 1. Tentative installation date for the 205 -- August 1, 1960. Programming technicians are currently being recruited.

KLEINSCHMIDT GETS FIVE AF CONTRACTS

Kleinschmidt Division of Smith-Corona Marchant has been awarded five contracts totaling $2,087,437 by the Army Signal Corps. Included in the contracts are orders for tactical sending and receiving units, receiving reperforators, tape transmitter distributors, and tape perforators.

RANDOM INDUSTRY INFORMATION

Burroughs Corp., will construct a $2 million engineering and administration building for its new Military Electronic Computer Division in Detroit. The plant builds electronic computers to guide Atlas ICBMs, and computers for use in the SAGE system of continental air defense.

Fairchild Camera and Instrument Corp., has entered the digital magnetic tape handling field with the purchase of all rights to the tape handling devices manufactured by Digitronics Corp.

Servomechanisms, Inc., has received a follow-on production order from Douglas Aircraft Co., amounting to $832,388 for the production of true airspeed computers. (Total Douglas order now is $2.5 million.)

Consolidated Electrodynamics Corp., will incorporate its Systems Division and operate it as a wholly owned subsidiary. The new company will be called Consolidated Systems Corp.

Ferranti-Packard Electric Ltd., Toronto, has received a $2 million order from Trans-Canada Airlines covering field and communication equipment used in conjunction with a central computer for reservations and other operating functions.

General Ceramics, Corp., Keasby, N.J., announces the formation of the Applied Logics Division to design, manufacture and market improved buffer memory systems.

Comment from the floor at a Western Joint Computer Conference technical session: "I hear that in some of the backward countries of Europe, they're still playing chess by hand."

new products in DATAMATION

shift register

Model SR-104 is a one-core-per-binary-bit unit, with a five KC information rate and a signal-to-noise ratio of

10:1. The operating temperature range is from —55° C. to 125° C. A 14.0 usec, 22 volt output pulse is obtained by applying a 10.0 usec, 7MA input pulse and subsequently an 8.0 usec., 300 MA shift pulse. The shift register is encapsulated in an epoxy compound and occupies a total volume of .2 cubic ins. For information write ESC CORP., 534 Bergan Blvd., Palisades Park, N. J.

Circle 100 on Reader Service Card.

programming connectors

A complete line of miniature, quick-disconnect programming connectors have an insert arrangement of 14 #16 contacts. There are a total of 60 plugs, 3 wired and coated for particular circuitry, and three standard receptacles. The various wiring arrangements in the plugs are indicated by code on colored tenite caps. Shell material is aluminum, dielectric is diallyl phthalate. Withdrawal forces are 5 to 10 pounds, insertion is 15 pounds maximum. For information write AMPHENOL ELECTRONICS CORP., 1830 S. 54th Ave., Chicago 50, Ill., or use reader card.

Circle 101 on Reader Service Card.

subcarrier oscillators

Adjustable and serviceable voltage-controlled FM subcarrier oscillators are now available for microwave data-transmitting use. Oscillators plug readily into a transmitting multiplexer with conventional 9-pin octal connectors. Tubes are mounted externally to dissipate heat. Overall size is 4⅞ in. by 3⅞ in. by 1⅝ in. Filament power can be either ac or dc. Input is ± 2.5 volts into 500 K ohms, and output is 3 volts at 5 K ohms from low pass output filter. Linearity is ± .75% of bandwidth, and harmonic distortion does not exceed .5%. For information write THE GEOTECHNICAL CORP., 3401 Shiloh Rd., Garland, Texas or use reader card.

Circle 102 on Reader Service Card.

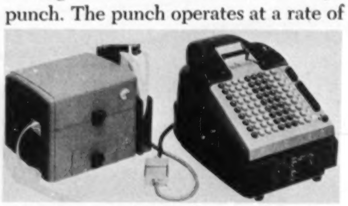
memory core handler

Model 4012 provides fully automatic or manual rate feeding of standard, 0.080 in. O.D., miniature ferrite memory cores to a testing point, in pilot line or full scale production line testing. Operating at a maximum handling rate of 3600 cores per hour, the 4012 provides for the separation of the tested cores in five different grades. The system is comprised of the electromechanical handler mechanism, a remote manual control unit, and the electronic control unit which includes power supplies and transistor operated control, logic and timing circuits, and which may be placed at any location remote from the actual handler mechanism. For information write RESE ENGINEERING, INC., 731 Arch Street, Philadelphia 6, Pa.

Circle 103 on Reader Service Card.

data punch

This unit consists of a full-keyboard adding machine which activates a tape punch. The punch operates at a rate of

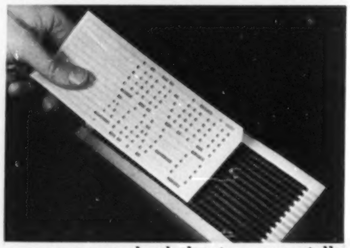


20 digits per second on power supplied by the adding machine. The data punch produces two records simultaneously — a detailed strip for immediate accounting data and a punched tape which can be directed to digital computers and data processors. Information on the punched tape can be converted to punched cards or magnetic tape for further processing. For information write VICTOR ADDING MACHINE CO., 3900 N. Rockwell St., Chicago 18, Ill., or use reader card.

Circle 104 on Reader Service Card.

photorectifier plates

These units, developed by MIT's Lincoln Laboratory, extend the range and increase the flexibility of digital com-



puter systems by behaving essentially like an array of diodes — with several important differences, according to the manufacturer. A single array is equivalent to a large conventional diode network yet requires practically no soldering and utilizes up to 1/20th the space. Packing densities of 100 "light cells" per square inch are now being manufactured. In addition, while photo diodes have diode characteristics whether illuminated or not, photorectifiers operate only when illuminated. This enables activation of required networks by simple masking techniques. For information write REX CORP., West Acton, Mass.

Circle 105 on Reader Service Card.

message relay set

Model 28 RT (reperforator transmitter-distributor) is a high capacity punched tape message relaying facility for receiving wire signals at speeds ranging from 60 to 200 words per minute, converting them into perforations and paper tape and transmitting them at the same or another speed to remote receiving stations. It is designed for data processing use among others. The set features three message relaying devices: a receiving unit for accepting incoming wire signals, a sending unit for reading and translating the taped data into electrical impulses for transmission, and a tape handling unit with tape supply reel. For information write TELETYPE CORPORATION, 4100 Fullerton, Chicago 39, Ill., or use card.

Circle 106 on Reader Service Card.

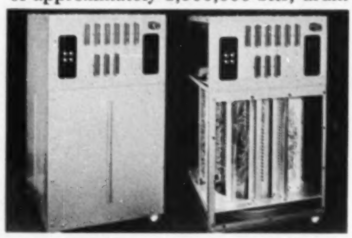
magnetic tape drive

As exhibited at the Western Joint Computer Conference, the 729 III magnetic tape drive features 375,000 bits per second transfer rate, 555 bits per inch density and 6.7 millisecond inter-record time. Access times – writing, 5.1 millisecond; read, 6.7 milliseconds. For information write INTERNATIONAL BUSINESS MACHINES CORP., Dept. of Information, 112 East Post Rd., White Plains, New York.

Circle 107 on Reader Service Card.

magnetic storage drum

Features of this new high-capacity magnetic storage drum include storage of approximately 1,500,000 bits; drum



surface T.I.R. runout of .0001 or less; recording surface coated with "Grimaco" grindable magnetic oxide coating, hardened and ground to a precise radial thickness. Drum dimensions are 10 in. in diameter by 16 in. long. Mounting is vertical. The entire assembly is housed in a dust tight cabinet measuring 25 in. by 25 in. by 30 in. high. For information write BRYANT COMPUTER PRODUCTS DIV., Springfield, Vermont., or use card.

Circle 108 on Reader Service Card.

drift transistors

Three new drift transistors – 2N643, 2N644, and 2N645 – of the p-n-p alloy type designed for high speed computer switching applications are now available. These transistors are intended for use and high-speed, nonsaturating switching circuits of computers such as inverters, flip-flops, and logical gates where high gain-band width product and pulse repetition rates up to 10 megacycles are primary design requirements. The transistors feature a minimum gain-bandwidth product of 20, 40, and 60 Mc, respectively. This makes possible the design of switching circuits having total rise, fall and propagation times in the order of 20 millimicroseconds, the manufacturer states. For information write RADIO CORPORATION OF AMERICA, Semiconductor and Materials Division, Somerville, New Jersey.

Circle 109 on Reader Service Card.

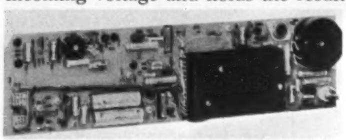
scanner plotter

Model 115 converts the uncorrelated information collected on IBM punched cards into visual plotted form for fast evaluation. Features include automatic operation with no paper changes, high-speed plotting – 400 graphs with 4,000 points in less than 2 hours, individual or multiple points on one graph, data points printed with numbers to separate and identify curves, and individual graphs for each channel. For information write GILMORE INDUSTRIES, INC., 13015 Woodland Ave., Cleveland 20, Ohio., or use reader card.

Circle 110 on Reader Service Card.

sample/hold system

This solid state system samples a small segment (less than 1 microsecond) of an incoming voltage and holds the result



for conversion to digital form or for other purposes. The system is constructed upon a single etched board, is self-powered, completely transistorized and has no moving parts; dc stabilization is provided by a silicon transistor chopper. Depending upon the rate of change of the incoming voltage, a recovery time of between 1 and 15 microseconds is required between samples. For information write PACKARD BELL COMPUTER CORP., 1905 S. Armacost Ave., Los Angeles 25, California or use reader card.

Circle 111 on Reader Service Card.

crystal diodes

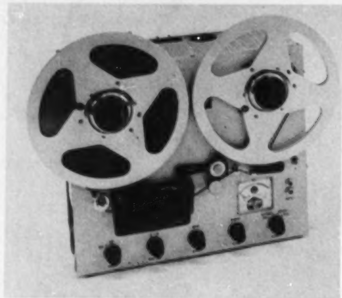
A line of all-glass, subminiature crystal diodes for data processing use and other military and commercial applications is available. The diode has a maximum body length of .265 in. and

a maximum diameter of .105 in. The new subminiature line includes three computer types, 1N191, 1N192 and IN198 which offer rapid recovery, excellent stability and high conductance. For information write SYLVANIA ELECTRIC PRODUCTS, INC., Semiconductor Division, Woburn, Mass.

Circle 112 on Reader Service Card.

tape transports

A feature of these magnetic tape transports, R-168 series is ease of modification to meet a maximum of specialized



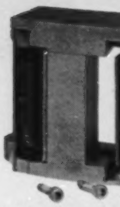
requirements. Two basic main front plate transport castings are optionally available to provide a choice of tape path and head cover arrangements. The R-168 operates at any two sequential speeds including combinations of tape speeds of: 15/16, 1⅞, 3¾, 7½, 15 and 30 ins. per second. Quarter inch tape capability is standard. Reels up to 10½ in. diameter are on the standard models. Push button local control, plug-in control, automatic cut-off and safety erase interlocks are provided as standard. Tape transport weight is approximately 39 pounds. For information write AMERICAN CONCERTONE DIV., American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif., or use reader service card.

Circle 113 on Reader Service Card.

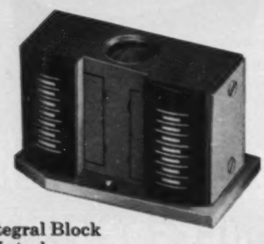
resistance set

These sets are designed for precision digital-analog conversion, analog resistance synthesis, and general laboratory standardization. Model BDR-105

CLEVITE 'BRUSH'



"Gap-Mounted."*

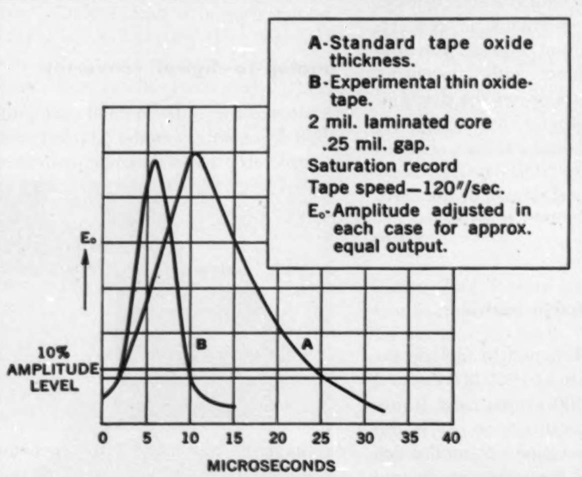


Integral Block Interlace.

Magnetic Heads for Digital Recording

Get more capacity... reliability...faster access ...whether you're designing a new pulse system... or modernizing your present one.

Why settle for less than the best magnetic head—the "heart" of your digital recording system? Whether your digital recorder is in the design stage, on order or in use now, Clevite "Brush" magnetic head specialists can improve your system at low cost. Write for prompt quotations on replacement or "modernization" heads for any existing transport, or specials including flux-responsive or high resolution heads. Write for Clevite Digital Recording Bulletin for complete information.



Pulse width comparison—standard and thin oxide tape.

CAPACITY—Five series of Clevite "Brush" multichannel heads give channel format variety for standard tape widths from ¼" to 2". A single block will handle up to 16 channels per inch of media width—an interlaced block up to 32 per inch. Clevite heads read pulse widths down to 1½ mils recorded to saturation on 0.3 mil coating instrumentation tape—approximately 600 pulses per inch with self-erasing saturation recording. More than 300 ppi packing is possible on 1 mil coated drums, operating 0.2 mils out of contact with a 3 mil pulse width on the drum.

ACCESS—Careful choice of material plus unique design and construction techniques enable Clevite "Brush" heads to provide uniform performance at very high processing rates. The heads themselves respond to wave lengths down to .15 mils (1.5 MC at 240 IPS) but standard instrumentation tapes and transports usually reduce the practical repetition rate of saturated recording to approximately 30 KC and 15 KC for RTZ and NRTZ respectively.

RELIABILITY— Clevite "Brush" tape and drum heads hold track width and location to ± 0.001-inch tolerance. Azimuth, contact angle and gap perpendicularity are true ± 0 deg., 5 min. and can be held even closer when required. "Gap-mounted" head (see photo) has lapped bracket and cartridge surfaces for fast replacement without critical adjustment. Redundant and interlaced (see photo) designs provide immediate checking of recorded data and higher output per channel respectively. All multichannel heads available in epoxy or full metal face (to reduce oxide pickup) at no extra charge.

* Patent Pending

CLEVITE ELECTRONIC COMPONENTS

DIVISION OF CLEVITE CORPORATION

3311 Perkins Avenue • Cleveland 14, Ohio

CERAMIC I. F. FILTERS, PIEZOELECTRIC CRYSTALS AND CERAMIC ELEMENTS, TRANSDUCERS

Field sales engineering offices in Newark, Chicago and Los Angeles.

Circle 14 on Reader Service Card.

resistance set consists of 21 resistors scaled in a modified, binary-decimal sequence of 1, 2, 2, 4 by decades with an extra units digit, permitting synthesis of any resistance from 0 to 100,000 ohms in one-ohm steps, with accuracies and stabilities from 0.0015% of the maximum value. By appropriate relay switching this set, in combination with an appropriate external reference standard, permits digital-to-analog conversion to approximately 0.01%. For information write JULIE RESEARCH LABORATORIES, INC., 556 W. 168th St., New York 32, N.Y.

Circle 114 on Reader Service Card.

analog-to-digital encoder

This device for converting rotary motion to a coded electrical output suitable for long-distance transmission and logging can be applied in any situation involving a shaft whose rotation may be stopped for short intervals. A coded output is obtained by using a metal-clad plastic disc with read-out brushes which are not normally in contact. Closing a read-out switch puts the brushes in contact with concentric, printed circuit tracks on the disc and then closes another switch which energizes the disc and contacts. For information write NORWOOD CONTROLS, Norwood, Mass., or use card.

Circle 115 on Reader Service Card.

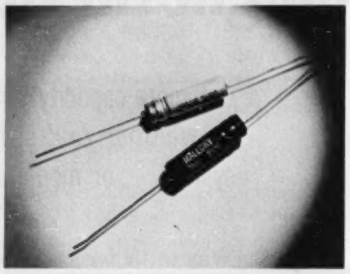
subcarrier discriminator

Model 951 is designed to include extended frequencies to 250,000 cps and outputs to 25,000 cps to meet future data systems requirements. It is designed for conversion of intelligence in the form of frequency modulated sub carriers to output voltages capable of operating most recording instruments. It features high stability, linearity, high current output capability, voltage or current feedback and an oscillating limiter. For information write MIDWESTERN INSTRUMENTS, 41st and Sheraton, Tulsa, Oklahoma.

Circle 116 on Reader Service Card.

electrolytic capacitors

Especially applicable to transistorized low voltage power supplies and to airborne uses requiring extreme reliabil-

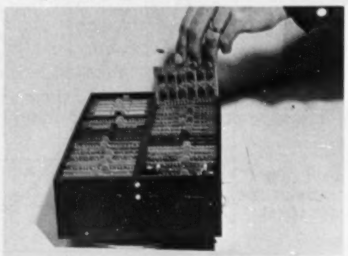


ity, the THR series can also be used as an equivalent of tantalum foil capacitors. A series of ratings from 75 mfd 3VDC to 100 mfd 25VDC is available in ⅜ in. diameter cases from ¾ in. to 1½ in. long, fitted with No. 20 tinned axial leads. Capacity tolerance is —10% to +100%; temperature range is —40C to +85°C. For information write P. R. MALLORY AND CO., INC., Indianapolis 6, Ind., or use card.

Circle 117 on Reader Service Card.

analog-to-digital converter

Known as the multi-channel analog-to-digital converter, model CG 591, this completely transistorized converter

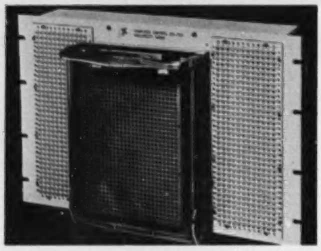


contains an automatic error checking system and digital readout. Utilizing the PCM method of operation, the new system attains accuracies of 0.2% and can be made compatible with any computer code because of its building block construction which uses modular techniques. Featuring built-in transient surge protection, the converter is adaptable to on-line entry into digital

computers. For information write GULTON INDUSTRIES, INC., 212 Durham Ave., Metuchen, New Jersey.
Circle 118 on Reader Service Card.

plugboard panel

Model PB-10 provides a means of obtaining a number of logical interconnections between T-PAC units. Units can be interchanged from one con-



figuration to another by replacement of the removable patchcord panel by another pre-patched panel. The model PB-10 consists of one panel-mounted AMP Universal Patchcord Programming System, containing 816 gold-plated contacts arranged in a 34 by 34 array. Each contact is brought out to a taper pin jack on the front terminal to permit convenient compatible wiring connections to the associated T-PAC terminals. The plugboard is center-mounted on a standard 19 in. by 12¼ in. rack panel. For information write COMPUTER CONTROL CO., INC., 92 Broad St., Wellesley, Mass.
Circle 119 on Reader Service Card.

data integrator

This device instantaneously combines existing or fixed data with variable information. It accepts fixed information

from punched cards and variable data from its keyboard. These items are automatically combined in a single block and translated together onto punched tape. The tape, combining both types of information, is immediately ready to be fed into computers, tape-to-card, or tape-to-tape converters and then to computers. For information write TALLER & COOPER, INC., Division of American Electronics, Inc., 75 Front St., Brooklyn 1, New York, or use reader service card.
Circle 120 on Reader Service Card.

sub-miniature diodes

Minifiers, sub-miniature selenium diodes, are assembled in drawn brass housing to provide heat dissipation and mechanical protection. The units are coated with a thermosetting material for environmental protection. The complete assembly is 3/32 in. in diameter and is insulated to permit use where space is a limiting factor. These diodes which can be used in computers and data processing equipment have a useful life expectancy of greater than 20,000 hours when operated within ratings. For information write INTERNATIONAL RESISTANCE CO., 401 N. Broad St., Philadelphia 8, Pa.
Circle 121 on Reader Service Card.

relay

Outstanding feature claimed by the manufacturer for this relay is that it has no moving parts. The electronic coil circuit operates at 28 volts dc, pole-in at 18 volts and drop-out at 11 volts or less with a positive snap action characteristic. The coil circuit is completely isolated from the electronic switching circuit making one coil circuit capable of switching many independent circuits within one unit. The unit will switch either ac or dc, has a transfer time of less than 50 microseconds and no contact bounce. For information write PEN-DAR, INC., P. O. Box 3355-W, Van Nuys, California.
Circle 122 on Reader Service Card.

DATAMATION *abroad*

BRITAIN'S ICT NOW SECOND EDP FIRM?

International Computers and Tabulators, a new British computer concern formed in February, claims to be the second largest firm in the world engaged in the manufacture of data processing equipment. I. C. T. was formed by a merger of the British Tabulating Machine Co. and Power-Samas Accounting Machines (owned by Metropolitan Vickers). DATAMATION's source states that the merger was brought about as a result of problems of competition raised by the formation of the Common Market in Europe.

DUTCH FIRM BUILDS COMPUTATION CENTER

Philips of Holland is building a large computation center in Eindhoven which, when completed, will be the largest of its type in Europe. The facility will function as a scientific research center.

CONVENTION INCLUDES COMPUTER TOPICS

Data handling and computer circuits will be among the topics covered at the International Convention on Transistors and Associated Semi-Conductor Devices to be held in London from May 25 to 29, 1959. The meeting is sponsored by England's IEE.

DP CONFAB PLANNED FOR MAY 14, 15

The first Nordic countries data processing conference will be held in Karlskrona, in Southern Sweden, May 14 and 15. Sponsored by the Swedish Board of Computing Machinery, the conference will cover operational analysis, data processing and technical problems. Special emphasis will be placed on latest developments in digital computers. An exhibition, the first of its kind ever held in Scandinavia, will be held in conjunction with the conference. About 300 sq. ft. will be provided each exhibitor. "It would seem like a good opportunity for outside firms who might be bringing equipment to Europe for the International Conference on Information Processing in Paris, to show their wares to another audience which has indicated a keen interest in data processing." So stated DATAMATION's European editor Etienne Guerin. Interested parties should contact Gunnar Havermark, Matematikmaskinnamnden, Box 6131, Stockholm, Sweden.

RUSSIANS CLAIM 'BIGGEST, BEST' AGAIN

A computer the Russians call "the most powerful in the world" is solving scientific problems at Kiev University, while another "unique" computer is being used to effect efficient exploitation of Soviet oil fields. The Kiev computer, a differential analyzer, is described by a Russian writer as "incorporating 24 integrators and characterized by a high degree of automation in all of its units." The oil field machine is said to illustrate Soviet mastery in series production of "specialized analog computers capable of investigating dynamic systems and other processes described by differential equations of the order 6 to 32." The "matrix-type electrointegrator" has a matrix of resistors and capacitors at 20,000 points. The computers are described in an article in the electronics section of a recent issue of Scientific Information Report, a review of current scientific and technological activities in the USSR, Eastern Europe and China. The periodical is prepared by the CIA from recent Soviet Block publications.

Refinements in computer design in the USSR, the article continues, are aimed at increasing calculating speeds, expanding storage capacity, improving logical capabilities, adding stable elements and decreasing size and power consumption. These design advances are said to be embodied in two nearly completed prototypes. One is a universal digital computer which the Russians claim will perform at a rate of 20,000 operations per second. The second machine is described by the Russians as a small digital computer with transistors, ferrites and miniature radio tubes in its circuits. Its control and arithmetic units will incorporate transistors and diodes. This machine is designed to operate at 2000 to 2500 single-address operations per second. Internal ferrite storage will consist of 2048 forty-column binary digits or 4096 commands. Two magnetic tape units will store 70,000 digits.

BRITAIN USING 100 COMPUTERS, 100 ORDERED

British computers and data processing equipment had advanced little beyond the drawing board stage five years ago. Today, about 100 computers are in use in Britain -- about half of them in scientific work -- and another 100 or so are on order, mainly for commercial purposes. Exports have been steadily increasing, according to the British Information Service. The Electronic Computer Exhibition held in London last December, the first of its kind to be held in Britain, provided an impressive picture of the growth of this industry. The variety of the equipment exhibited by 41 manufacturers (many from the U.S. and the Continent) included 12 operating digital computers and five on display, 23 functioning input devices and 19 output devices, four magnetic tape units and 12 magnetic drums, and eight analog computers.

In the forefront of Britain's computer industry are these machines and manufacturers: Perseus, Pegasus and Mercury, all manufactured by Ferranti; Metrovic, manufactured by Metropolitan Vickers Electrical Co. Ltd.; the 802 Compudesk -- National-Elliot; Pluto, a product of collaboration between Powers-Samas and Ferranti; Emidec, by E. M. I. Electronics Ltd.; Leo, produced by Leo Computers Ltd.; Deuce (Mark I and II), manufactured by English Electric Co. Ltd. In output equipment, the Creed Model 3000 tape punch has attracted much attention. It features speeds of 3000 words per minute. Britain's computer of the future is Ace.

SWEDISH UNIT GETS NOD OVER LGP-30, 650

Gevaert Brussels, Belgian manufacturers of photographic supplies, will purchase a Swedish-made Wegematic 1000 (an improved Alwac 3E). This will be the first delivery of the machine. An LGP-30 was found to be too small for Gevaert's purposes and a 650 was rejected because of the firm's lack of interest in punched card equipment.

DATAMATION *on campus*

UNIVERSITY'S EDP ROLE DISCUSSED

"The Role of the University in Computers, Data Processing and Related Fields" was the title of a paper presented at the Western Joint Computer Conference by Louis Fein, Consultant, Palo Alto, Calif. DATAMATION feels that in covering this area, Mr. Fein made statements which deserve consideration by universities now offering a data processing program and those contemplating such a move. We now quote the author on Policy -- "Probably 150 universities and colleges are engaged in some kind of (computer) activity . . . The purpose of the schools that first got involved was 'to get their feet wet' (in an attractive field) . . . (Now) only a few universities have made a determined effort to select a field of interest, set up a policy and goal, and implement it . . .

"The most important impact on university programs in these areas has been the education program of IBM . . . IBM has 'presented' 650's to over 50 universities by now, under the condition . . . that a couple of courses in data processing and numerical analysis be given. (The author noted that UCLA has a 709, MIT a 704, Univ. of Calif. a 701.) Sperry Rand Corp., Burroughs Corp., Bendix, Royal McBee and . . . other computer manufacturers have also 'contributed' computers to universities. (In an appendix, Fein listed, 110 universities with machines.) "It is fair to say that, in many cases, to the extent that a university computer activity has a purpose at all, it has been made for them by IBM. It is true that for many universities, this is good. Otherwise, they may never have gotten around to a program at all. Nevertheless, there are no distinguished academic centers of computers, data processing, and related fields, and I believe that this is so because not enough attention has yet been given to the development of an integrated program and policy in response to the needs and conditions of the whole community rather than as a supplement to computers obtained at a 'bargain' . . .

Organization -- Sometimes an interdepartmental committee is in charge of the service and of a few courses. Sometimes all courses are given in one department without any necessary relation between course content and department . . .

Faculty -- "The range and variety of faculty participating in university computer and data processing programs compares favorably to the range and variety of the programs themselves. Everyone from the novice to people with ten years of experience is participating. Part-time instructors from industry and government have been used. Interest, without regard to experience and competence, is sometimes the main requisite of the teacher . . . With the exception of some instruction in programming, courses for faculty training hardly exist . . ."

NEW DATA DEVICE DEVELOPED

will provide multiple, long-distance access to computers

A further stride in mechanization of time-consuming clerical routines of business and government was announced recently by the Western Electric Company at a demonstration of a new invention designed for use with telephone company Dataphone service. Dataphone service provides for the transmission of data over regular telephone connections. Thus, this new device, which has not yet been named, will provide multiple access, unlimited by distance, to modern, high speed computers.

The development was sparked by a search on the part of the manufacturing and supply unit of the Bell System, the Western Electric Company, for better ways of ordering supplies from the company by employees of Bell telephone companies. Other Bell applications are being considered.

An experimental model is currently being demonstrated by engineers to several Federal agencies and to some 35 business machine manufacturers to acquaint them with its capabilities and to interest them in manufacturing and marketing the transmission device for general public use. Field tests are planned to validate proposed use of the device.

Laurin L. Sevebeck of Western Electric, a co-inventor of the equipment, explained that the new facility now being perfected could not be made available to potential users by business machine manufacturers for several months to come.

He described the problem which, it is hoped, use of the new device with Dataphone service will solve. The company, he said, receives about 500,000 large and small orders monthly from telephone companies for tens of thousands of items carried in stock. More direct methods of feeding orders to the distribution centers and into data processing machinery would improve efficiency and speed up all phases of filling orders, inventory control and accounting.

The new device, operating in conjunction with Dataphone service, is designed to move input of data away from the data processing center to hundreds of originating points. From there data would be transmitted in machine language directly to the data processing center with no intermediate steps. Thus, wasteful manual duplication would be avoided. Moreover, Dataphone service permits information formerly mailed to be flashed over regular telephone lines with a consequent saving in time.

Sevebeck said the electronic apparatus at a receiving center could accept data sent over telephone connections from many scattered points, by means of small, low-cost transmitters like the model he demonstrated Information flowing from these points into the center could be recorded automatically on paper tape or punch cards, then transferred directly into standard data processing machines.

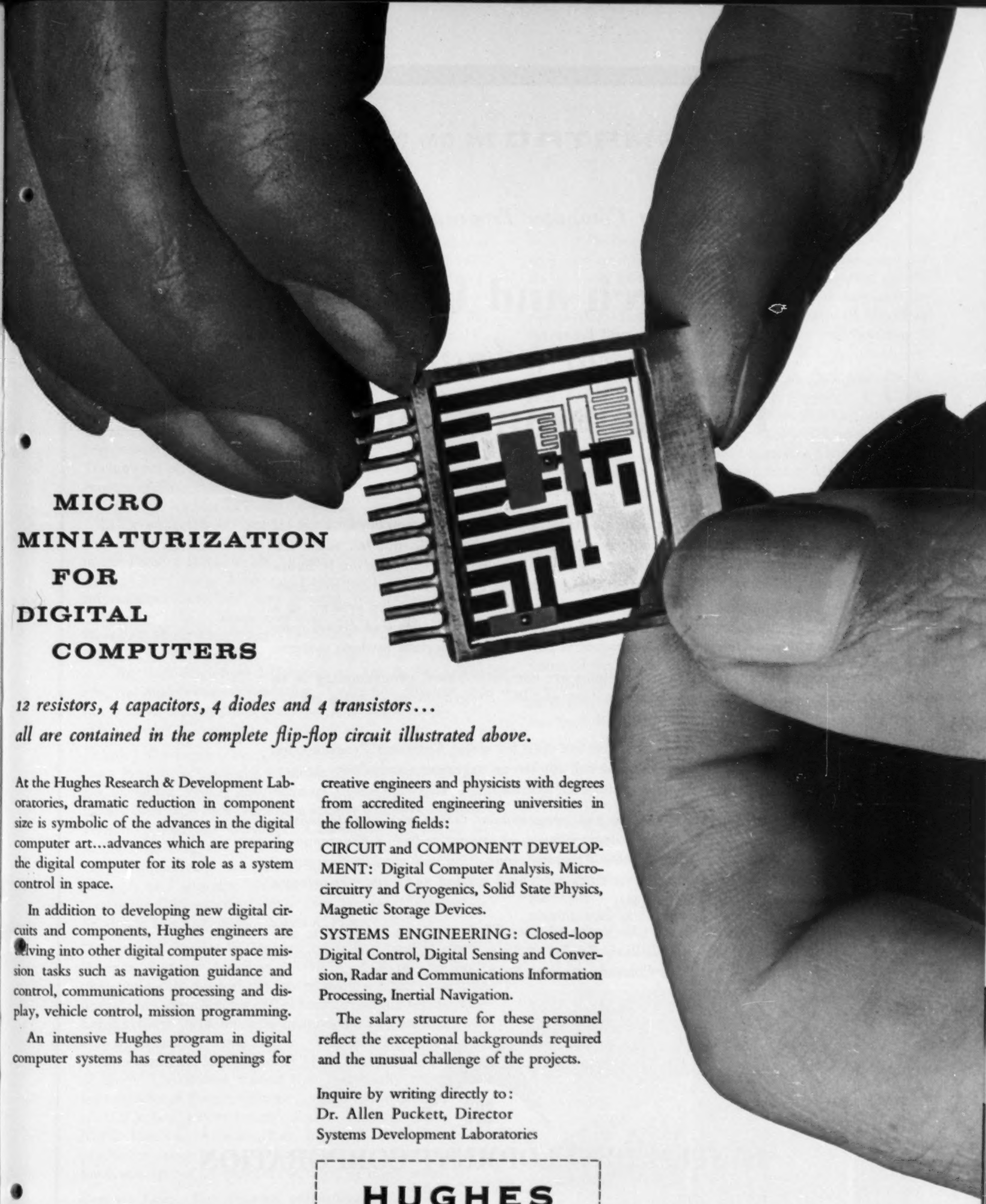
The multiple input feature of the system which is inherent in Dataphone service would help to solve the stubborn problem of making large and costly computers justifiable in the solution of many business problems. Such information is usually assembled, reprocessed and then checked manually for insertion into the computers or other devices. Upon considering computer speeds, the question has been how to supply enough information to them conveniently and economically in the case of business operations.

The first large-scale trial of this development will get underway this Spring with the installation of transmitting and receiving units in the states of New York and Illinois. Telephone company men using the new equipment to transmit orders to Western Electric will have small identification cards, containing code punch marks. They will also have a supply of similar cards with punched code numbers describing items they would have occasion to order.

The telephone company employee using the service would insert his identification card in the card reader — part of the transmitting device. This automatically establishes his authority to order materials and specifies delivery information. Next, he would insert cards corresponding to the items he wished to order. The quantity of each item would be transmitted by pressing numbered keys on the top of the device. ●

An engineer prepares to implement Bell System's new Dataphone development. After telephoning the receiving center, he is ready to send business data through the card reader. This can be done by using small punched cards or the numbered pushbuttons.

At receiving point, girl puts Dataphone equipment on the telephone line by throwing a key. This connects the distant sender to the card punch (background) which will record transmitted information on cards, for direct use in data processing equipment.



To Senior Computer Programmers interested in

Research and Development *on advanced* Programming Techniques

Those interested in performing research and development on advanced programming techniques will find full scope for their ability at System Development Corporation in Santa Monica, California. SDC's projects are concerned primarily with developing large-scale, computer-centered systems in a number of fields. The application of advanced digital computer techniques is particularly important in these systems.

As these systems are computer-based, programming is an essential function at SDC. *Programming is not a service activity at SDC.*

A few positions are open for senior Computer Programmers. The positions call for strong experience and ability in programming and keen interest in:

Mechanical and programmed techniques of information retrieval—Logical design of computers from a Programmer's point of view—Pattern recognition and machine learning—Language translation (both natural and computer-oriented languages).

Those who desire additional information are invited to contact William Keefer at System Development Corporation, 2478 Colorado Avenue, Santa Monica, California.

SDC

SYSTEM DEVELOPMENT CORPORATION

Santa Monica, California

11-90E

Circle 52 on Reader Service Card.

people moving up in DATAMATION

Selected to fill responsible positions at the International Conference on Information Processing (Paris, June 15-20) are thirteen U.S. computer experts. Heading the list, **Prof. Howard Aikens,** director of the Harvard University Computation Lab, will be Honorary Chairman; **Dr. J. W. Mauchly,** Rem Rand, Honorary Vice Chairman. **Dr. Saul F. Gorn,** Univ. of Pennsylvania, is appointed Rapporteur for a plenary session – "Common Symbolic Language for Digital Computers." Serving as Plenary Session Presidents are **Dr. A. S. Householder,** Oak Ridge National Lab., and **I. L. Auerbach,** Auerbach Electronics Corp. Their sessions are, respectively, "High-Speed Computation" and "Computer Techniques of the Future." **Dr. S. N. Alexander,** National Bureau of Standards, and **Dr. Grace Hopper,** Rem Rand, are Vice Presidents of Plenary Sessions.

Other appointments are for Symposia Sessions – a special section of topics which cannot be covered adequately in the Plenary Sessions: **Dr. Gilbert W. King,** IBM, "Influence of Very Large Memory Designs and Capabilities on Information Retrieval;" **Dr. Richard W. Hamming,** Bell Telephone Labs., "Error Detection and Correction;" **Dr. David G. Hays,** Rand Corp., "Machine Translation;" **Prof. Nicholas C. Metropolis,** Univ. of Chicago, "Logic Organization for Very High-Speed Computers;" **Dr. B. W. Adkinson,** National Science Foundation, "Collection, Storage and Retrieval of Information;" **Dr. Alan J. Perlis,** Carnegie Inst. of Technology, "Automatic Programming."

Joseph J. Guidrey has been appointed manager of Sylvania's Data Processing Center in Camillus, N.Y. He succeeds **Edgar G. Dunn,** who is now assistant to the controller. Sylvania's Needham data processing facility will have as supervisor of production, **Gerald E. LaRochelle** . . . **David R. Miller** is now director of marketing for Colorado Research Corp., Broomfield, Colo. **Mark Harris II** succeeds Miller as manager of Computer Systems Div . . . To head Bendix Computer Engineering Dept.'s new Applied Mathematics Section in Los Angeles is, **Charles A. Piper.**

Commander George W. Hoover, recently retired Manager, Weapon Systems Air Branch, Office of Naval Research (internationally dubbed the "space man" – holds numerous honors) became Director of Technical Planning for Benson-Lehner Corp. Will serve as member of staff on basic research; formulate long range directions for company. Hoover was awarded Legion of Merit in name of President of the U.S. – citation named him "personally responsible for initiation of Project Orbiter . . . later led to development of U.S.'s first successful satellite." . . . Autonetics, div. North American Aviation, Inc., named **E. A. Holmes, III** product manager of Industrial Products . . . **Terry R. Burton** is manager of advertising and sales, BJ Electronics.

Genesys Corp., Los Angeles, announces **Gifford K. Johnson's** appointment as president. He will direct data processing systems program, among other duties. He is also appointed director and vp for corporate business planning at Chance Vought Aircraft, Inc., (Genesys is the new commercial electronics subsidiary) . . . Burroughs Corp., Detroit has established a Military Electronic Computer Division there and appointed **Edward W. Schening** general manager . . . **Trude C. Taylor,** vp of marketing at Telemeter Magnetics, Inc., was elected to Board of Directors; **Raymond Stuart-Williams** elected a vp – will continue to direct the engineering department at T.M.I.

Three promotions at IBM Research Lab., San Jose: **Dr. Albert S. Hoagland,** Senior Research Engineer; **J. A. McLaughlin** and **Dr. James T. Smith,** Research Engineers. Appointed manager of IBM Los Angeles Applied Science Dept., is **Lloyd C. Hubbard** – succeeds **Alvin L. Harmon** now manager of applied programming, systems development, White Plains, N.Y. **Charles J. Lawson, Jr.,** promoted to assistant director of manufacturing services, IBM New York City – is succeeded by **Clarence E. Frizzell** (ex-San Jose) as general manager at Rochester plant. San Jose Research Lab, appoints **Emil Hopner,** manager of data transmission project; Miss **Phyllis Baxendale,** research engineer.

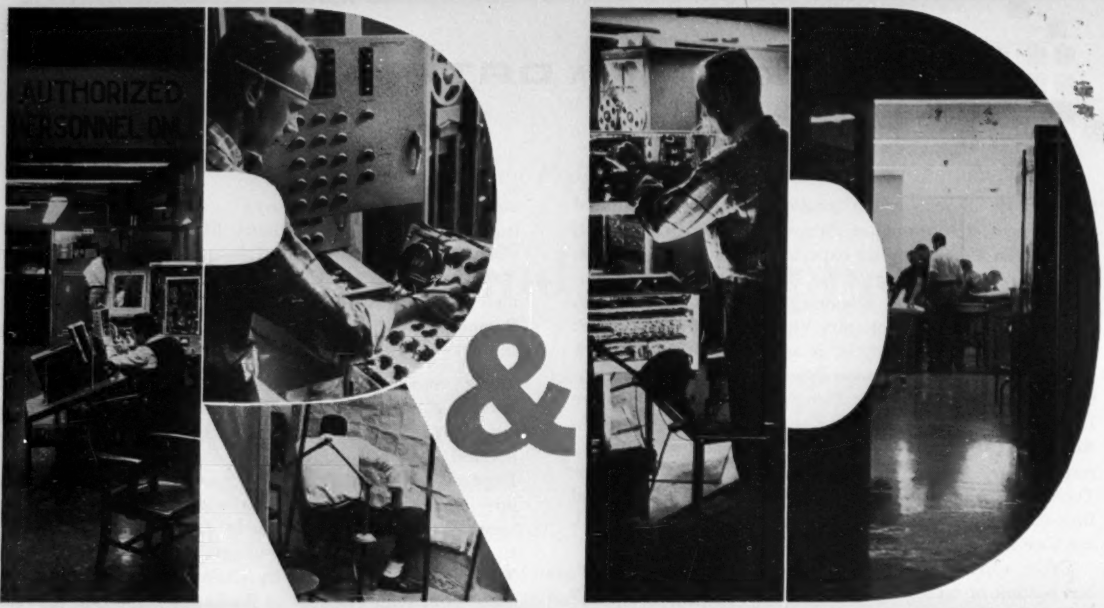
U. Victor Turner has been appointed manager of manufacturing at Data-Control Systems, Inc., Danbury, Conn. . . . the Berkeley Division of Beckman Instruments has announced that **Charles H. Single** is now computer engineering manager . . . CEC has named **Roger E. Holmes** as chief of the technical information bureau . . . **DuPuy F. Cayce** has been appointed sales manager of data processing equipment for GE's Computer Department in Phoenix.

Underwood Corp., N.Y., has appointed **Gayle W. Forcade** marketing manager of the data processing div., where he will coordinate and direct all marketing within that area, including Data-Flo, UEBC and Samas; serve as liaison in development of new products . . . Epsco-West has named **Stanley F. Molner** senior applications engineer – he will specialize in special purpose digital computers and other applications . . . Five men have joined the professional engineering staff of Control Data Corp., Minneapolis: **Trygve A. Hauge, Arthur C. Gannett, Charles E. Cooper, Charles L. Hawley, Jr.,** electrical engineers, and **Dean C. Laurance,** mechanical engineer.

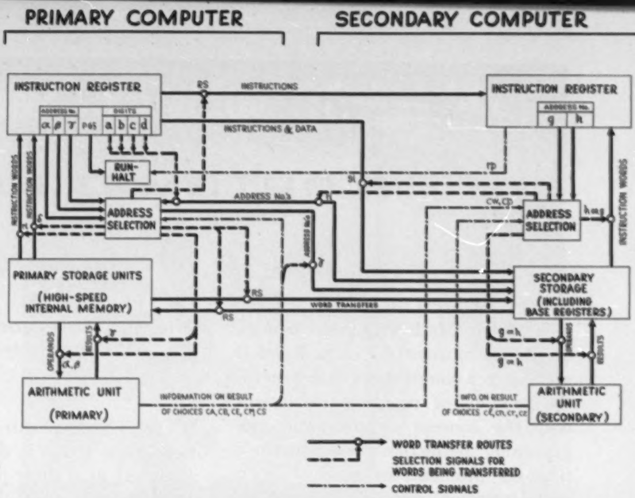
J. J. Guidrey
Sylvania Electric Products

G. W. Hoover
Director, Tech Planning Benson-Lehner

G. K. Johnson
President, Genesys Corporation



ORGANIZING a NETWORK of COMPUTERS



The National Bureau of Standards has been investigating the logical problems arising when several high-speed electronic computers are connected together to work on a common large-scale task. In organizing such a network, many logical problems are encountered that do not ordinarily occur in the usual single-computer system. One problem is that of devising an efficient scheme for enabling all the computers to share among themselves, automatically, the total workload undertaken by the network. Another problem is that of designing a machine instruction system which can carry out these complex operations effectively and yet is simple enough to code easily. Techniques for attacking and solving these problems were investigated by A. L. Leiner, W. A. Notz, J. L. Smith, and A. Weinberger of the Bureau's data-processing systems laboratory. One significant result has been the design of the new NBS Pilot Data Processor, a multi-computer network with powerful data-processing capabilities.

Many large-scale data-processing jobs, for which solutions are now urgently required, call for much faster computing capabilities than presently available machines can provide. The resulting demand for computer components of higher basic speed has in many respects exceeded the resources of the current component technology. As a consequence, in order to shorten problem-solving times, it became necessary to try to organize these components into more powerful logical combinations for doing the job. One mode of approach is to connect together several computers into an integrated network so that all of the machines in the network could be made to work together on large scale tasks. By dividing up the total task into different pieces, and by having all the different computers in the system work on different pieces of the task **simultaneously,** an increase in the speed of solution can be achieved.

Under ideal circumstances, the entire job could be split up into pieces that are completely independent, and each computer could carry out its assigned portion of the work without interacting on the other machines in the network. In actual practice, however, this ideal of complete independence cannot be attained because the results of one set of computations will, as a rule, be needed as input data for another set, and the starting of one phase of operations will have to wait for the ending of another phase. When these successive phases are carried out by several different computers, one machine may have to stop and wait idly for data from another if the different steps are not properly coordinated – thereby wasting time. The amount of productive time that might be lost in this way had to be evaluated before an efficient network system could be designed. It was found that queuing-theory techniques could be applied to evaluating such losses and to devising schemes for making computers in the network share a common workload.

In the theoretical investigation undertaken by the Bureau to evaluate the operation of multi-computer networks, a simple model network containing two computers was set up. In this model a primary computer shares its workload with a secondary computer connected to it via transmission lines. Three types of communication between the machines are possible: (1)outgoing data from the primary to the secondary, (2) incoming data from the secondary, and (3) control signals between the secondary and the primary. The distinction between primary and secondary computer is based on the rules by which the initiative for carrying out interchanges between the two machines is assigned.

Although both types are considered as independent internally programmed computers, the primary is the one that initiates the joint transactions between the two. The primary transmits a job request from time to time to the secondary to carry out some specific job. The secondary then starts immediately to carry out the indicated job, while the primary continues working, performing computations that do not need the secondary's result data.

The sequence of events for the most elementary type of system would be as follows: At the beginning, the primary initiates a request to the secondary. Some time later, the secondary finishes its job, halts, and sends a "job completed" notice back to the primary. At this time, however, the primary may not be at a stage in its program where it wishes to accept the offered data. A delay ensues, during which the primary continues to run while the secondary remains idle, waiting for further orders from the primary. As soon as the primary reaches a suitable point in its program, it issues a "call-back" order to the secondary and then immediately accepts the data that is returned to it. After its results have been accepted, the secondary remains idle until the primary transmits another request to it. This 3-phase cycle of (1) job-request, (2) job-completed notice, and (3) call-back order, continues until data-processing is completed.

This simple model is a fair approximation to some practical task-sharing applications. As a rule, though, certain further complications need to be taken into account. These complications arise when the nature of the task is such that the primary program cannot be formulated so as to schedule its job requests to the secondary far enough in advance. As a result, it may not always be possible for the primary to be kept busy doing useful work during the time the secondary is working. The primary may issue its call-back order prematurely – that is, before the secondary has finished its job – and therefore the primary may have to stop and remain idle until the secondary can respond to the call-back order. One computer or the other, then, may sometimes wait, but both machines are never halted simultaneously. ●

new DATAMATION literature

MATH COMPILER MANUAL: A new Matrix Math Compiler manual, of interest to users of Univac I and II systems, is a comprehensive system for the solution of complex problems — with the concept of automatic programming. Reduction of programming time for problems in areas of operations research, scientific research, or engineering studies, the manual provides complete instructions for preparation of pseudo-code input and operation of the compiler on the computer. For copy write REMINGTON RAND, 315 Fourth Ave., New York 10, N.Y., or use reader service card.
Circle 200 on Reader Service Card.

MEMORY SYSTEM: Model 3122 Random Access Store for buffer and memory requirements in data processing systems is described and illustrated in a four-page bulletin 58-B. Mentioned is the use of the standard apertured ferrite plate as the storage medium — access time of 12 microseconds, capacity of 512 eight binary digit characters and random access for both writing and reading. Bulletin includes timing diagrams, specifications, accessories, applications and description of other random access stores in the 3100 series. For copy write RESE ENGINEERING, INC., 731 Arch St., Philadelphia 6, Pa., or use reader card.
Circle 201 on Reader Service Card.

DIGITAL ENCODER: Model EPD-3 shaft position, magnetic readout digital encoder is described in a two-page leaflet with diagrams. The direct, angular-position-to-binary-decimal output encoder employs magnetic readout principle similar to that used in computer memories. Features include — ruggedness and simplicity for industrial applications with poor environments; acceptance of any process variable as shaft-position input, gives binary-decimal digital output; minimum circuitry needed; reliability and long-life — readout involves no mechanical or optical contacts. For copy write APPLIED SCIENCE CORPORATION OF PRINCETON, P.O. Box 44, Princeton, New Jersey, or use card.
Circle 202 on Reader Service Card.

TAPE TESTER: An automatic magnetic tape tester is described and illustrated in a three-page leaflet. The tester records multi-channel pulses on the tape — a reproduce amplifier for each channel inspects the tape for dropouts and time displacement errors. Individual defects are marked on the tape and on a graphic record. Total tape footage and a defect count are indicated. Characteristics include 6 and 8 in. reels containing any tape lengths, testing speed of 25 in., per second (1500 feet in 12 minutes), rewind speed of 120 in. per second (1500 feet in 2½ minutes). For copy write GENERAL KINETICS INC., 555 23rd Street, S., Arlington 2, Va., or use card.
Circle 203 on Reader Service Card.

DIGITAL PLOTTER: Specifications, diagrams and a description of the model 201 high speed digital plotter are contained in a four-page leaflet. Plotting visibly at speeds up to 8 points per second with four symbols, or up to 20 per second with random symbols, the results of computers can be plotted immediately to spotlight performance without delay. The plotted result is a series of mechanically generated printed impressions on paper or vellum. For copy write TALLY REGISTER CORP., 5300 14th Ave. N.W., Seattle 7, Washington, or use reader card.
Circle 204 on Reader Service Card.

TELEMETRY REDUCTION: Basic automatic (independent, compatible) telemetry data reduction systems are described in an eight-page brochure. Combined, they will provide integrated universal systems to automatically reduce FM, PAM, PDM, and PCM telemetry data into magnetic tape format, compatible with digital computers. Illustrations of systems are included in brochure along with system of operation, specifications and optional equipment for quick-look display. For copy write EPSCO, INC., 588 Commonwealth Ave., Boston 15, Mass., or use reader service card.
Circle 205 on Reader Service Card.

COMPUTING SERVICE CENTER: Detailed in a twelve page illustrated folder are the computing services offered at this company's center. A group of specialists at the center will provide problem analysis, mathematical analysis, programming, coding, machine time, training, full operation of customer's computer facility. For copy write GENERAL ELECTRIC CO., Computer Department, 13430 N. Black Canyon Highway, Phoenix, Ariz., or use reader service card.
Circle 206 on Reader Service Card.

COMPUTER PLATFORM FRAMES: Describing company's V-LOK interlocking steel framing for computer platforms, a four-page illustrated bulletin MA-159 covers framing members which facilitate the installation, electrical connection, and air-conditioning of electronic computer assemblies. Structural elements may be assembled to form a platform of any desired size which may be later changed to accommodate different computer assembly. For copy write MACOMBER INC., Canton, Ohio., or use reader card.
Circle 207 on Reader Service Card.

DIGITAL PROCESSOR: The Micro-SADIC high-speed digital processor for static and quasi-static test data is described and illustrated in a six page bulletin No. 3004. The equipment accepts and commutates analog signals (rate of up to 10,000 samples per second), converts them into digital form, and records on magnetic tape in a programmed format suitable for introduction into most standard computers. MicroSADIC accepts from one to a multitude high-level or amplified low-level analog inputs which may be generated by low-level devices such as thermocouples, strain gages and other trans-

ducers. For copy write CONSOLIDATED ELECTRODYNAMICS CORP., Systems Division, 300 N. Sierra Madre Villa, Pasadena, California.
Circle 208 on Reader Service Card.

GENERAL PURPOSE COMPUTER: A six-page illustrated brochure, S-526R1, gives specifications, basic features, major components and lists applications of the LGP-30 general purpose computer. Operation of control panel and 16-part command table are described. New optional photo-electric punched tape reader (200 characters per second) and combination high-speed reader and punch unit are illustrated. For copy write ROYAL McBEE CORP., Data Processing Division, Port Chester, N.Y., or use reader card.
Circle 209 on Reader Service Card.

COMPONENT CATALOG: Two-page bulletin G-100 describes representative instruments of manufacturer's complete instrument product line. Instruments described include data processing and calibration equipment, force instrumentation, electronic weighing units and special recording instrumentation for strain gages and thermocouples. For copy write GILMORE INDUSTRIES, INC., 13015 Woodland Ave., Cleveland 20, Ohio.
Circle 210 on Reader Service Card.

MATHEMATICAL TRAINING INSTRUMENT: The Microlog, model 2A, an instrument designed specifically for the training of engineers and management in the simulation of processes, giving approximate solutions in engineering mathematics to test stability of systems, is described in a data sheet, M-2. This new Microlog eliminates the need for miniature computers at the preliminary training stage, according to the manufacturer. For copy write EBE, INC., Computer Manufacturing Division, 1015 Atkin Ave., Salt Lake City 6, Utah, or use reader card.
Circle 211 on Reader Service Card.

NEW LITERATURE

CONTROL SYSTEMS/MEMORY PROCESSOR: Detailed description of Genesys control computer systems is contained in an eight-page folder, with illustrations and diagrams. Optimizing computer monitors process variables, stores operating parameters, signals alarm indicators, automatically checks for reliability and directly controls actuators and power elements. Folder contains detailed leaflet on company's memory processor – with disc memory serving as general computational and memory unit for data acquisition and handling systems. For copy write GENESYS CORP., 10131 National Blvd., Los Angeles 34, California.
Circle 212 on Reader Service Card.

SURVEY REPORT: A four-page application report (bulletin No. IB 018) describes the ways in which the G-15 general purpose digital computer is being used in the petroleum industry. Applications have included, exploration, marketing of finished products, reservoir studies, geophysical prospecting over water, water flooding, catalytic cracking, reforming, blending of stocks, equipment design, pipeline construction and analysis of marketing statistics. For copy write BENDIX COMPUTER DIVISION, 5630 Arbor Vitae Street, Los Angeles 45, Calif.
Circle 213 on Reader Service Card.

TRANSISTORS AND LOGIC BLOCKS: A complete line of direct coupled transistors and logic blocks is presented in an illustrated, detailed folder. Manufacturer claims that with these cards it is possible to assemble and evaluate any logical or command network required in digital computation or data handling design – cards are designed to be compatible with each other. Folder includes descriptions of combinatorial digital devices – and gate, or gate, pulse amplifier, inverter, monostable multivibrator, bistable multivibrator, and specifications on digital voltmeter. For copy write CG ELECTRONICS CORP., Subsid-

iary of Gulton Industries, Inc., 15000 Central, East, Albuquerque, New Mexico, or use reader service card.
Circle 214 on Reader Service Card.

DIGITAL DEMAND RECORDER: An impulse counting and recording device is described in a sixteen page catalog, fully illustrated. Developed to help automate electric utility customer billing and record data for load survey studies, the recorder is now used for production control, traffic counting and atomic energy work applications. For copy write FISCHER AND PORTER CO., 828 Jacksonville Rd., Hatboro, Pennsylvania, or use reader card.
Circle 215 on Reader Service Card.

TEXTBOOK ON COMPUTERS: A new textbook on the basic principles, language and characteristics of electronic computers is entitled, "The Language and Symbology of Digital Computer Systems." The 114-page book discusses Boolean algebra in practical terms, contains a cross reference of logic diagrams and symbols used by various manufacturers and a dictionary of computer terminology . . . affording a common index for engineering and non-engineering people. For copy send $2 to Government Service Department (Bldg. 210), RCA Service Company, Camden 8, New Jersey.

FUTURE REFERENCE: A new booklet entitled, "A Preview of the Leisure Years," is directed to men and women approaching retirement age and is of use to executives concerned with conditioning employees to this idea. Some subjects explored: general attitudes toward retirement, importance of developing potentially useful activities, financial planning, protection of health, Social Security, where to live in retirement, travel, etc. For copy write RETIREMENT EDUCATION, INC., Dept. D, Caxton Building, Cleveland 15, Ohio.

COMPUTER CONFERENCES
the wjcc

more observations, more suggestions

The "blue sky" session wasn't very blue, the ideas weren't exactly new, much of the same old equipment was trotted in . . . and yet most of the 1800 delegates came away from the Western Joint Computer Conference (San Francisco, March 3-5) with the feeling that the meeting had been a good one.

Some of the technical papers attracted more than usual attention. Several, which could have been categorized as "blue sky," were scattered liberally in other sessions. Thus we found C. N. Mooers discussing "The Next Twenty Years In Information Retrieval: Some Goals and Predictions;" J. Rothstein holding forth on "Can Computers Help Solve Society's Problems" and – what sky could be bluer? – J. McLeod and J. Stroud discussing "The Man – Computer Team in Space Echology."

Louis Fein, a Palo Alto consultant, took a well-prepared, healthy swing at computer programs in our universities when he cited "The Role of the University in Computers, Data Processing and Related Fields." (See Datamation On Campus.)

Braving the slings and arrows of practically everybody (because of the sensational tone of his paper's title) another Louis, Sutro, now with MIT's Instrumentation Laboratory staff, discussed a problem which, in all likelihood, will eventually have to be faced – "The Emergency Simulation of the Duties of the President of The United States." Sutro thoughtfully injected the words "of the Duties" at a WJCC press conference, thus robbing local news reporters of a juicy headline.

As for the exhibits, the trend of showing at conferences equipment which actually works was graduated a step further. Several pieces of equipment displayed at the WJCC were running continuously throughout the conference.

Not much in the way of new equipment was evident. Soroban Engineering had a new paper tape perforator clacking away at 240 characters/second (the man said it could hit 300). IBM had its 729 III tape handler running every few minutes and ElectroData's high speed tape reader stopped hardly at all for three days.

some general observations

To move from specifics to generalities . . . in the last issue of DATAMATION a quartet from RAND Corporation took the often-used "long, hard look" at joint computer conferences, particularly the Eastern Joint Computer Conference held in December. They concluded that the efforts of admittedly hard-working committees were not evident from the resulting sessions and exhibits.

They scored the lack of preparation on the part of speakers, the haphazard organization of papers into sessions, the narrow bounds in the content of these papers, etc., etc.

No one will question the value of the just-completed WJCC. DATAMATION heard comments which were clearly appreciative of the complex job of organizing and presenting conference material. The concensus was, however, that with more care in the scheduling of papers, more preparation by speakers and more attention to technical niceties, the sessions could have been tremendously improved.

In a constructive vein, DATAMATION has one suggestion to offer at this time. In organizing these conferences, wouldn't it make sense to attempt to establish continuity by carrying part of the staff of the current conference into the planning and execution of the next?

For instance, this year's chairman could be next year's vice chairman, this year's technical chairman could serve on the next technical chairman's committee. Thus a continuing, organized flow of ideas would be established.
We know that experience is the best teacher so why thrust conference planning on a completely green staff year after year? DATAMATION will welcome reader's comments on this subject.

U. S. TO PRESENT 23 ICIP

many american firms exhibiting

With the announcement that thirteen U.S. computer experts have been chosen for important posts at the International Conference on Information Processing, to be held in Paris, June 15-20, (see People Moving Up . . .), clear indication is made of the strong international position held by American computer technology in the field of electronic data processing. The formal technical program of 55 papers will feature 23 from the U.S.; five of the thirteen symposia sessions will be coordinated by U.S. experts. This country will be represented on the program in all of the major areas covered by the conference and over 600 Americans have made known their intention to attend the conference and exhibit. Other countries participating at the Plenary Sessions include: Austria, Belgium, Czechoslovakia, France, Germany, Israel, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, the USSR and the United Kingdom.

The plenary sessions, covering five subject areas, will be divided into ten three-hour periods at the new UNESCO House, June 15-20. A general rapporteur will present an introductory discussion on each of the five subjects. (There will be simultaneous oral translation of each paper into English, French, Russian and German.) All abstracts, preprints, will be provided to conference registrants prior to the conference.

At AUTO-MATH 59, the major computer and data control equipment exhibit to be held in conjunction with the conference, June 13-23, major American companies will be exhibiting directly and through foreign subsidiaries. These companies will include: IBM-France, Royal McBee through Mecanalyse, Benson-Lehner Corp., Burroughs Corp., Teleregister Corp., Friden, Telemeter Magnetics, Ampex Corp., Minnesota Mining and Manufacturing Corp. Six papers on

PAPERS IN JUNE

new equipment developments in the U.S. have been provisionally accepted by UNESCO consultants (organizers of ICIP) for presentation during AUTO-MATH technical sessions. These are: The 220 High Speed Printer System (Burroughs); S-C 5000 and S-C 4020 High Speed Electronic Digital Computer Readout Systems (Gen. Dynamics Corp., Stromberg-Carlson); Magnacard – Storage of Information on Magnetic Cards (Magnavox Co.); Advanced RW-300 Computer Systems (Thompson-Ramo-Wooldridge); The Source Document Processing Center (Telemeter Magnetics); and Royal Precision Data Processing Systems (Librascope).

Data processing machines at Remington Rand Univac in Washington will aid the U.S. Committee for the ICIP in its liaison with three designated air carriers (special flights have been blocked off) by processing the travel requirements of the contingent of attendees to the conference from this country. KLM is an official international carrier, scheduling departures from New York from June 8-13; American Airlines, connecting carrier; Scandinavian Airlines System, international carrier from the West Coast via the polar route, scheduling departures from June 7-13. ●

ADVERTISERS agencies

FIRST CLASS
Permit No. 10194
New York, N.Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY

Reader Information Department

R/E RESEARCH & ENGINEERING

The Magazine of DATAMATION

103 Park Avenue
New York 17, New York

DATAMATION

R/E READER SERVICE CARD Mar./Apr. 1959
NOT GOOD AFTER June 1, 1959

(Please print plainly or type. Show full company name.)

Name_______________

Title_______________

Company_______________

Address_______________

City__________ Zone______ State__________

☐ I would like to be added to your list to receive
RESEARCH & ENGINEERING,
The Magazine of DATAMATION

☐ CHANGE MY ADDRESS
(Show PRESENT connection ABOVE;
list FORMER HERE)

Company_______________

City & State_______________

FOR MORE INFORMATION, ADVERTISEMENTS, EDITORIAL ITEMS

	10	20	30	40	100	110	120	130	140	200	210	220	230	240
1	11	21	31	41	101	111	121	131	141	201	211	221	231	241
2	12	22	32	42	102	112	122	132	142	202	212	222	232	242
3	13	23	33	43	103	113	123	133	143	203	213	223	233	243
4	14	24	34	44	104	114	124	134	144	204	214	224	234	244
5	15	25	35	45	105	115	125	135	145	205	215	225	235	245
6	16	26	36	46	106	116	126	136	146	206	216	226	236	246
7	17	27	37	47	107	117	127	137	147	207	217	227	237	247
8	18	28	38	48	108	118	128	138	148	208	218	228	238	248
9	19	29	39	49	109	119	129	139	149	209	219	229	239	249

For information on employment ads fill in below:

Name_______________

Home address_______________

City__________ Zone______ State__________

50	55	60	65
51	56	61	66
52	57	62	67
53	58	63	68
54	59	64	69